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THE
HYGIENIC TREATMENT
OF
PULMONARY CONSUMPTION.

BY
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SOCIETY OF MONTREAL.

"I can only wish that the errors of this book may find no favour,
but perish speedily, and that the truths it humbly aims to set
forth may do their good and beautiful work."

THEODORE PARKER.

LONDON:
JOHN CHURCHILL, NEW BURLINGTON STREET.

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T. RICHARDS, 37, GREAT QUEEN STREET.

TO
JOHN LEE, LL.D., F.R.S., F.R.A.S.,
OF HARTWELL HOUSE,
PRESIDENT OF THE BRITISH METEOROLOGICAL SOCIETY,

IN RECOGNITION OF
HIS EARNESTNESS IN THE CAUSE OF SCIENCE
AND KNOWLEDGE,
OF HIS LIBERAL SERVICES AND AID IN ALL EFFORTS THAT
TEND TO ADD TO THE HEALTH AND THE
HAPPINESS OF MANKIND,

AND
IN GRATEFUL REMEMBRANCE
OF MANY PERSONAL KINDNESSES,

THIS ESSAY IS INSCRIBED,

BY HIS OBLIGED FRIEND,

THE AUTHOR.

P R E F A C E .

THE greater part of the present Essay appeared some months ago, as an original paper, in the *SANITARY REVIEW AND JOURNAL OF PUBLIC HEALTH*. The favourable reception given to the paper was far more decisive than I had at all anticipated ; and, in republishing it in this separate and expanded form, I am only responding to the wishes of numerous learned and earnest friends.

The views given in the forthcoming chapters, though more fully wrought out than in any previous work, are by no means new, as the reader will find as he proceeds. But, though not new, they have been as yet but little acted on, and have, indeed, only been advanced by a few enthusiastic men, who spoke a language and an argument which in their day was not understood. But old things are passing away in this time ; and from every point of the scientific sphere new light is being cast on the great questions of life in all its varied phenomena, and on the natural laws by which only it can be maintained.

The word, therefore, has gone forth, and has no denial, "Whoever would live well and enjoy existence, must live by Nature, and learn from her." This word is the truth here enforced ; and, although I have invented no panacea, thrown out no tempting morsel to the deluded sick, pandered to none of the absurdities of social life, held out no hope of assistance from man, unless such assistance be based on faith in Nature, and on a knowledge of her simple but absolute laws, the argument of experience tells me already that I have neither laboured nor written in vain.

12, Hinde Street, Manchester Square,
January 28, 1857.

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THE HYGIENIC TREATMENT OF PULMONARY CONSUMPTION.

CHAPTER I.

PRELIMINARY CONSIDERATIONS. PROGRESS OF HYGIENIC
MEDICINE IN MODERN TIMES. HYGIENE AS APPLIED TO
PRACTICE. POPULAR PREJUDICES. VIEWS OF PARRISH,
SALVADORI, MAY, RUSH, JACKSON, AND M'CORMAC, ON THE
HYGIENIC TREATMENT OF CONSUMPTION.

THE progress of hygienic medicine in the last few years is the medical fact of the present age, and the fact that will stand out in boldest relief when the history of this period shall be written by some future Esculapian scholar.

But, rapid and effective as this progress has been, the principles of hygiene are yet but in their infancy. We have learned to appreciate the true value of hygienic principles in the prevention of various diseases, especially those of the epidemic type ; and the medical profession, throwing aside all selfish recollections, has been the first to teach the practice of these principles, and to prove their force and vitality. The next step in the way of advancement is to demonstrate that the same principles are as useful and as necessary in the

treatment of actual disease as they are in prevention. In this field of labour ground is indeed broken. Our physicians are trusting in part to the ventilation of the hospital ward, and to a careful regimen, for the cure of many of their patients; while Stromeyer and others are showing absolutely that the one and true remedy for the typhus-stricken victim is pure air in abundance.

A great advantage in the hygienic treatment in disease is, that it does not, or at least need not, interfere with sound and experience-proved modes of treatment of a medicinal kind. An ague patient is benefited by hygienic measures, but this is no reason why he should not at the same time be subjected to the well known curative effects of cinchona. An anæmic child is made to inhale pure air, and to exercise its limbs, but this is no reason why it should not also be medicinally plied with steel. The scientific physician finds, in fact, that there is always a consistent plan for combining the medicinal and hygienic systems. He sees that the two systems are one; he sees further that the mere medicinal plan without the hygienic is in all cases imperfect, and in some cases worse than imperfect. Will all the medicines in the Pharmacopœia cure small-pox in a patient shut out from the air, and breathing steadily his own poison emanations? The dream of such a possibility is past now.

The practical details of hygienic medicine in relation to the treatment of disease have, however, yet to be wrought out more fully. This will be sure work, but slow. Necessarily slow, because it is hard to give up old friendships in dogmatism; while to effect a cure in a sick man by fresh air alone, or diet, is infinitely less satisfactory to the public, than to assume to effect the same cure by a bread pill. I know

some earnest men in the profession who are afraid to abandon the routine of pills, draughts, lotions, and what not, because such abandonment knocks head against the foibles of those who seek to be cured by such means, and who will recognise no other means. Nor is there want of argument in this course, though its morality may be open to criticism. A dispensary patient came to me lately, to be cured of a headache. I saw what seemed to be the cause, and without prescribing on her letter, gave in words what promised to be the remedy. The patient came no more; but I asked after her casually one day of a friend who brought her to see me. "Oh!" was the reply, "she has no faith in you; you only told her to sleep in a room with a chimney in it, and to sleep alone; so now she is getting cooling medicine from a druggist, and some days she is worse, and some days she is better." Always worse, I take it, after the cooling medicine. It would be easy to multiply these illustrations, but this one is a fair representation of others.

It is vain, it is sticking in the slough of hopelessness, to pander to these popular imbecilities; for though they must die out, and, indeed, are dying out daily, they will go the sooner if they are effectually damped, and if something real and common sense is put in their place. *Scientiæ mutantur, et nos mutamur in illis.* There is a time when medicines are invaluable; but if faith in medicines is to be retained, the times for their administration, as well as their selection, must be learned by knowledge, not by routine; and must be dictated by the circumstances of the case, not by the caprice of the patient. The executive of science must be independent, if it would keep in the path of truth and advancement.

In such progress as has been made in the science of treat-

ment by medicines, it has been found useful to take up certain particular diseases, and to observe in them, individually, the effects of particular remedies. This rule will apply with equal force in considering and investigating hygienic modes of treatment. Each practitioner should, as his opportunities permit, observe as carefully the effects of his hygienic commands, as he does those of the medicines he may prescribe. He should compare also the one mode with the other, and calculate in each case their relative advantages. In this way he will have the advantage of detecting with greater accuracy the pure effects of medicines themselves; seeing that the action of medicines is greatly modified by the external conditions to which he who takes them is subjected.

Convinced of the importance of the above considerations, I have made it my business for some time past to mark out a series of hygienic rules for the treatment of consumptives; and as I have been happily favoured by the best and widest opportunities of carrying out these rules in practice, and as the results have been most satisfactory, I lay the views, given in succeeding chapters, respectfully and briefly before the profession and the public, but without making the proposition of anything like a specific cure for the disease in question.

The idea of a hygienic code for consumptives is by no means new, but it has as yet been limited and incomplete. On the diet of consumptives volumes have been written, and specific diets have been invented as abundantly as have specific pills and plasters. Out-door exercise also, the necessity of which it will be my task earnestly to enforce, has been often urged, and some conscientious men have earned for themselves not a little disrepute by the pertinacity with

which they have pressed their views on this point on the attention of the public. An American physician, Dr. Parrish, in a number of the *North American Medical and Surgical Journal* for 1830, wrote thus :—

“ Vigorous exercises, and a free exposure to air, are by far the most efficient remedies in pulmonary consumption. It is not, however, that kind of exercise usually prescribed for invalids—an occasional walk or ride in pleasant weather, with strict confinement in the intervals—from which much good is to be expected. Daily and long continued riding on horseback or in a carriage is, perhaps, the best mode of exercise ; but where this cannot be commanded, unremitting exertion of almost any kind in the open air, amounting even to labour, will be found highly beneficial. Nor should the weather be scrupulously studied. Though I would not advise a consumptive patient to expose himself recklessly to the severest inclemencies of the weather, I would, nevertheless, warn him against allowing the dread of taking cold to confine him on every occasion when the temperature may be low, or the skies overcast.

“ I may be told that the patient is often too feeble to be able to bear exertion ; but except in the last stage, where every remedy must prove unavailing, I believe there are few who cannot use exercise out of doors ; and it sometimes happens that those who are exceedingly debilitated, find, upon making the trial, that their strength is increased by the effort, and that the more they exert themselves the better able they are to support the exertion.”

M. Salvadori, of Trent, and a Mr. May espoused a similar view even long previous to the time of Dr. Parrish. These gentlemen, Salvadori and May, proposed and carried out,

for consumptives, the plan of supplying them freely with the most nutritious foods, such as beef and wine, and of subjecting them also to vigorous exercises, such as climbing mountains and taking prolonged walks. Salvadori trusted to this alone, and ignored medicines. Mr. May used bark, opiates, and emetics, and conjoined a swinging gymnastic exercise to his treatment.

Dr. Rush gave an opinion that exercise in the cold air was useful in hæmoptysis, and commended the hardship of active military service as the most effectual remedy in many cases of confirmed consumption.

Recently Dr. Jackson, another American physician, has taught the same doctrine in his work entitled *Letters to a Young Physician*, and has gone further than Dr. Parrish towards forming an extended hygienic system of treatment. He has given instructions on diet and clothing, but his great argument, like that of his predecessor, is in favour of exercise, and of free exposure at all times to a pure air, in consumptive cases.

I must not omit to refer also to the opinions of Dr. M'Cormac, which practically run in the same direction, but which are connected with a theory held by him as to the origin of tubercle. It is apart from my present purpose to discuss the question of the origin of tubercle, and I therefore need only refer to the fact, that pure air in abundance is, in the opinion of Dr. M'Cormac, the essential preventive against the commencement of consumption, and the most essential remedy when the disease has made its appearance.

CHAPTER II.

OUTLINE OF A HYGIENIC CODE FOR THE TREATMENT OF CONSUMPTIVES. RULES RELATING TO A SUPPLY OF PURE AIR, AND TO ACTIVE EXERCISE, AS APPLIED TO THE TREATMENT OF CONSUMPTION.

IN giving the following rules I presuppose their general applicability to cases of consumption in all stages of the disease: in the premonitory stage; in the stage when the tubercular deposition is evident; and in the next stage, when the local mischief is much further advanced. In the last stage even, though hope is lost, many of the rules may still be rigidly followed out with advantage, for by them the course of the disease is smoothed, and sometimes life is prolonged. In like manner, the rules are generally applicable to those who by hereditary taint are as yet but predisposed to the disease.

RULE I.

A supply of pure air for respiration is the first indication in the treatment of the consumptive patient.

In all cases of consumption, the attention of the physician should be at once directed to the quality of the air breathed by the patient. It may seem dogmatical, but it is true, that in

an atmosphere containing one per cent. of the carbonic acid of the breath, with the natural but as yet undetermined amount of ammonia evolved in combination with the carbonic acid, a consumptive patient, though in the earliest stage of the disease, cannot possibly recover under any form of medicinal treatment; while in those predisposed to the disease, the inhalation of such an atmosphere, even at intervals, will aid materially in inducing the first symptoms of the disease. In saying one per cent. of carbonic acid, I have taken a high figure, because it is known that in health the respiration of such an atmosphere for a long time is hurtful. How much more so, then, in consumption, where the patient, by reason of the imperfect play of the lungs, is already taking in too little air!

In large cities, and even in small towns, it is next to impossible to get a constant supply of pure air in inhabited houses; for houses are built according to false notions of comfort. "What a nice cozy room," is a common expression applied innocently to every place where the greatest care has been taken to make an air vault, without a "draught," and all ready for being charged with invisible impurities.

In a cozy room the consumptive is bound never to live, nor in any room indeed for great lengths of time. So long as he is able to be out of doors, he is in his best and safest home. In the fields, on the hills, wherever the fresh air vivifies, where plants look most vigorous, and animals frisk about in the joy of health, there will the consumptive draw in his choicest medicine, there dissolve and throw off most freely the germs of his disease, and there repair most easily the tissues he has lost.

The inclemencies of the weather may temporarily, it is

true, prevent the patient from his out-door existence. But even these inclemencies are not so much to be dreaded as confinement in a house. I had occasion, some time since, repeatedly to remark that if, from a few days rain, the consumptives under my care were confined to their homes, instead of being able to take the daily out-door breathing always prescribed, under such circumstances the aggravation of symptoms was always marked and universal. The appetite fell off, the debility became greater, the mind was less buoyant, the local mischief increased. The patients, too, previously accustomed to a full dose of the air food, were not ignorant of the cause of these changes, for reduction in air is felt as quickly as reduction in common diet. Seeing these evils, then, I have lately thrown off the alarm about bad weather, and have ordered every patient to seize on an inclement day each gleam of sunshine, for the purpose of getting out for a breath of fresh air. The result of this practice has been most gratifying in all cases where the courage of the patient has admitted of its application.

Dr. Jackson, in speaking of out-door life, in much the same terms as the above, dwells very properly on the necessity of securing for this plan the confidence of the patient. The treatment "should not be done rashly, but boldly." If possible, "the patient should be made to have faith in it; for without this he is not likely to pursue it as far as he can, and then he will not derive from it all the benefit which it can afford." This is the fact; but the difficulty is at once got over if, under favourable conditions, the invalid can be induced to try the measure for a few days. Once tried, there is no fear, in the majority of cases, of its being given up, except in instances where the disease is too far advanced,

or where, from the poverty of the patient, the pursuit of a sedentary occupation must needs be followed, even to the last days of existence. The benefit derived from this treatment is indeed so obvious, the debility is so much better borne, the relish for food is so much more markedly felt, the nights are passed with so much less of restlessness and cough, and with such an increase of sleep, that the sufferer soon instinctively feels the value of his instructions, and follows them out even more punctually than those which relate to the taking of medicines.

As much of the day, then, as is possible should be spent by the consumptive in the open air, and in places where the air is least impeded and least corrupted. When he is compelled to keep the house, the necessary precautions must again be taken for procuring a free admission of the atmosphere. No cozy room with a temperature at 70° , with every crevice closed, and with an atmosphere in a dead calm and laden with impurities, should be permitted. But the temperature should be from 55° to 65° Fahr.; the fire, if there is one, should be in an open grate; and by perforated panes in the windows, and a free chimney vent secured by an Arnott valve, the freest possible current of air should be kept circulating through the room. If the patient is cold, let him approach the fire, but let him not labour under the popular and fatal error, that the way to obtain animal warmth is to shut out the air and roast the body. The heat of the body is made in the body itself, by virtue mainly of the oxygen supplied in the air; and as the body absorbs external heat with great difficulty, it would be as wise to attempt to give warmth by fires, hot bottles, and hot air, to a man who is not inhaling a due amount of oxygen, as to attempt the

same process on a marble statue. In a word, external heat is useful only in preventing the too rapid radiation of animal heat from the surface of the animal body. Alone, it cannot supply heat ; but when a wholesome air is inspired, it can secure the retention of the heat that is manufactured in the animal furnace.

I spoke a moment ago of the open fire-grate. This is an essential for the room of the consumptive. Stoves of all kinds, heated pipes, and, in a word, all modes of supplying artificial warmth, except that by the radiation from an open fire, are, according to the facts which I have been able to collect, injurious. They are injurious, because by such means the air is made too dry, an objection much less applicable to the open fire. If compelled to live in a room heated by a stove or by hot water pipes, or if the air in a room heated by an open fire be too dry, as may occur during north-east winds, the consumptive patient should meet the difficulty by allowing the steam from boiling water to be diffused through the apartment. I have known a patient to be kept awake with constant dry cough during the whole night from what seemed, in great part, the dryness of the atmosphere, and have been able to afford relief by the simple suggestion named above.

But the evil effects arising from the common closed stove are as nothing compared with the system of heating an apartment by hot air passing into the room from an iron flue. It is a fortunate fact that this monstrous system of warming is now fast going into disuse, for a second time in this country. The air thus heated bears with it minute irritating particles, which to healthy lungs are hurtful, and to phthisical lungs fatal.

The symptom which I have most commonly seen elicited in the phthisical, by the inhalation of an unnaturally dry air, is hæmoptysis, a symptom brought on possibly by the constant cough which the dry air excites. This effect, in a minor degree, will, in fact, appear in some cases without any actual deposition of tubercular matter, under the influence of the cause just described. A gentleman whom I knew, and whose lungs were free from tubercle and other organic disorder, was constantly annoyed and troubled with slight attacks of hacking cough and blood-spitting. He was at a loss to account for the cause. At last he detected that the attacks always commenced when he was at work in his study. With the idea of being very warm and comfortable, and ignorant of the nature of animal heat, he had introduced into a small room a large Burton's stove. To a stranger entering that room when the stove was in action, and the doors and windows snugly closed, the heat and dryness of the atmosphere would have been at once oppressive; but he, a close student, and constantly occupying the room under such conditions, had become accustomed to it as regards external sensation, but caught the mischief effectually in the chest. The cause of the symptoms being explained, the stove was abandoned, and the open fire-grate was again resorted to: the cough and blood spitting at once disappeared without the administration of any medicine. A few weeks afterwards, thinking that the stove and the cough might only stand in the position of coincidences, our student resumed the use of the stove: and what is more, resumed also the cough and the blood expectoration. This time he became assured that the stove and cough stood in the relation of cause and effect. The cause was once more removed, and ever since he has remained free of the hæmoptysis.

The temperature of the air in the room of the consumptive should range from 55° to 65° Fahr., and he himself should learn to observe by the thermometer that he is living in an air of this degree of warmth. I have been accustomed to recommend Bennett's shilling thermometers for this purpose, since they are sufficiently accurate, and come within the means of the poorest patient. My friend Mr. Glaisher, than whom no one is more competent to speak on this point, recommends two thermometers, the one with a wetted bulb. By the use of these the humidity, as well as the temperature, can be regulated. This would be most advantageous, and the sensations of a consumptive patient would soon inform him what degree of moisture was comfortable and proper.

But there is yet a desideratum in practical hygiene, to which the Rev. C. Girdlestone has drawn attention; viz., an instrument for indicating at all times the amount of carbonic acid gas present in the air of any apartment, and as simply constructed as the barometer or thermometer.

I must say a word about schoolrooms in this place. If any father or mother have a child of consumptive tendency, I beg them to send him to no school until they have personally inspected the schoolroom, in regard to its ventilation and to the mode in which it is warmed.

The worst constructed stoves, the worst plans of ventilation, are, I regret to say, to be found in these public rooms, even in those of the best class; and boys are not uncommonly punished for being stupid, when they are really in a semi-torpid state from the effects of one of the most active gaseous narcotics—carbonic acid. If a child of consumptive birth

be carefully brought up, with strict regard to sound physiological rules, there is always a chance of carrying him fairly into manhood, and beyond the period at which tubercle so commonly presents itself. But if such a child be sent from home to spend six or eight hours a-day amongst a troop of other children, in an unventilated room, dry heated by iron stoves, that child has no chance; his disease is being drilled into him, *pari passu*, with his learning, and the end is forthcoming.

I have occasionally heard phthisical patients complain of the use of gas in the rooms where they are confined. Such complaints, however, have usually come from patients confined in workshops where the number of burners is very great, and where there is almost always some accidental escape of gas.

In private houses such objections are avoidable; but as the inhalation of coal gas is injurious even in small quantities, and as the products of the combustion of such gas are also hurtful, the necessity of a free ventilation in rooms where it is burned and in which consumptives are lodged, is the more urgent.

The care that should be taken to secure a good air in the living rooms of the phthisical invalid, must extend with equal care to the sleeping apartment. This rule should always obtain when possible; *never permit one room to perform the two offices of bedroom and living room.* The bedroom should be large, unencumbered by needless furniture, and thoroughly ventilated. If the temperature of the air without is not below 60° Fahr., the windows of the room should be boldly set open, and be kept open all night. If they are to be closed of necessity, a free chimney draught

must be procured, and an Arnott's valve is always an advantage. In the absence of this, a bent tube may be used, as described in another page of this work. The bed should be free of curtains, but a single screen may be placed so as to ward off any direct draught from the door or window. Warmth of body is best secured by woollen bedclothes; but if the temperature of the air is below 60° , it will with advantage be raised to that pitch by a fire in the open grate. Gas should on no pretence be burned through the night in this bedroom, and as few other lights as possible, for the patient requires all the air that is to be had, and must not be carelessly robbed of it. Above all things, the consumptive person should be the sole occupant of his own bed and bedroom. To place such an one for several hours close to another person, however healthy, is injurious to both, but especially to the sick. No ties of relationship, and no mistaken kindness, should cause this rule of isolation ever to be broken.

It has been stated already that the room of the sufferer should be large. It should include, whenever practicable, at least 1,000 cubic feet of breathing space, under all plans of ventilation. If more space can be had, all the better. If less only is obtainable, then the ventilation must be the more carefully attended to.

When the patient has left his room in the morning, and he should do so early, the windows and doors should be set open, and a current of air be allowed to flow through it during the whole of the day. If the air of the apartment be at a temperature below 60° Fahr., or loaded with moisture, the fire should be lighted before bedtime. In thus preparing a bedroom for the reception of the sick, I have known nurses,

either in ignorance or in idleness, take up a chaffer of lighted coke, or a warming-pan full of live coals, and set it in the centre of the room to effect the "airing" process. This act is nothing less than a systematic diffusion of coke poison.

The inhalation of products of combustion of all kinds is always injurious to the phthisical patient; but in no case is it so injurious as when coke has been used. For the products evolved from burning coke are invisible, and therefore the more dangerous. From a coke fire, carbonic acid gas is the product most freely evolved; but Dr. John Davy, in a report on coke poisoning in a church at Ambleside,* states it as his opinion that carbonic oxide is also a product. If this be the case—and Dr. Davy's arguments are decisive, and deserve to be received with great respect—we have from the coke fire a much more dangerous and rapidly acting poison than carbonic acid itself.

But whatever the products of a coke fire may be chemically, their effects on animal bodies are unmistakeable. In the case given by Dr. Davy, about four hundred people were congregated in a church during service, and were subjected by accident to the coke vapour. The church was large, being capable of holding 150,000 cubic feet of air; yet the majority of those present suffered from symptoms of faintness, vomiting, headache, and great exhaustion prior to recovery.

The inhalation of common coal or wood smoke is less injurious to the phthisical than the vapour arising from coke; though some woods in burning evolve empyreumatic vapours, which are exceedingly irritating, and are sure to excite cough:

* JOURNAL OF PUBLIC HEALTH for January 1856.

they should therefore be avoided as fuel. The burning of pastiles to destroy the *smell* of bad air, instead of opening the window, is not only a lazy, filthy, ignorant plan, but one which generally succeeds in setting up a coughing fit in the consumptive patient. This custom should be universally abandoned. The effects of the inhalation of coal smoke are of necessity bad. The latest and most able writer on smoke, Mr. C. W. Williams, shows that what is commonly called smoke, namely, the blue vapour arising from a coal fire, is composed of three gaseous bodies—carbonic acid gas, nitrogen, and water vapour; the colour given to the whole being due to the presence of uncombined carbon in very minute quantity, namely, something less than a grain to the cubic foot of the smoke. The carbonic acid is here again mischievous; nor is the free carbon, little as it may be in quantity, without its evils. In damp, foggy weather, when in the large town the smoke finds no free escape or diffusion in the atmosphere, this carbonaceous stuff is inhaled into the lungs, gives a dark coal looking tint to the expectorated matter, and is a constant source of irritation to those who are suffering from chest disease.

Thus the inhalation of an atmosphere charged with smoke is necessarily an evil in the case of the consumptive. In a large town it is difficult to escape from this evil; for if in a London fog it is injurious for the phthisical man to walk out of doors, his condition in the house is little less favourable. He escapes the damp mist outside, in fact, to breathe in a heated room, which in foggy seasons cannot be freely ventilated, the products of his own combustion, and of those arising from artificial lights, which are in essence the same.

Use of respirators.

Consumptive patients frequently ask, especially in winter time, the value of what are called respirators; and I have known some poor people to purchase things of this description at what was to them considerable cost. The use of mufflers, which are, in fact, respirators, has been known for ages; and Dr. Hales, more than a century ago, recommended a scientifically made muffler for persons obliged to enter into places where noxious gases were given off. Dr. Beddoes too, as Dr. Arnott shows, pointed out, in the year 1802, that a few folds of gauze held over the mouth and nose made the air warm and moist for respiration, and that such mufflers were, therefore, useful to consumptive and asthmatic persons. The object of the muffler or respirator is this; it retains the heat thrown out in the expired air, and gives up this heat to the cold air that enters in inspiration. In cold dry weather the muffler is very useful, and should be worn by all phthisical patients when out of doors; but when the air is moist and cold it sometimes is complained of, as embarrassing the respiration. It should then be thrown aside. Any patient may easily make one of these mufflers for himself, for the cost of a few pence, out of a piece of fine wire gauze, cut oval so as to cover the mouth and nose, and fixed in the centre of a handkerchief, so that it may be tied on like an ordinary comforter, with the gauze in the centre for breathing through.

Hospitals for the consumptive.

Before leaving the subject of pure air as a remedy for the consumptive, I regret to be obliged to offer an opinion which

is, I know, exeptional, and which is therefore given with the firmness of a conscientious conviction, but with the respect due to the opinions of the majority. I am about to speak of the confinement of consumptives in hospitals. That a vast deal of good is, or may be, done at these institutions by the treatment prescribed by the physicians who attend at them, and whose lives are devoted to the study of the disease, there cannot be a doubt. But that it is a physiological, and a sound practical treatment, to receive into these buildings consumptive patients, is an assumption I must most earnestly dispute. I know the excellent spirit in which institutions of this kind are founded. I am fully aware of the care that is bestowed on the inmates; of the attempts that are made to introduce every hygienic improvement; of the order and cleanliness that prevail; of the kindness of the attendants; of the excellence of the diet roll; and of the skill of the physicians. With all this, it is to me as clear as crystal, that to bring phthisical patients into such institutions is a great eharitable mistake. The very care, and waiting-servant attention, that is paid to such of the invalids as are in the first and second stages of the disease, is a cruel kindness. The remedy for these is to encourage and urge them to assist themselves, and to exert themselves. Moreover, no kind of hygienic system, carried on in a large building filled with inmates, can make the air of that building in any way equal to the outer air, which it is so necessary that the consumptive person should breathe. Twenty patients, lying in one hospital ward, will throw off per minute into the air of the ward at least three and a half eubic feet of expired and impure gases, rendered in the phthisical the more impure by the pathological condition of the lungs. But the

impure air thus exhaled vitiates by its diffusion twenty times its own volume of pure air ; so that, in fact, in a ward with twenty patients, there are not less than seventy cubic feet of air spoiled per minute, and rendered unfit for the purposes of life. It may be granted that during the day, when the wards are less full, and many windows are open, and the movements of the inmates are active, the expired air may be fairly disposed of. But take a winter night of twelve hours ; consider that in this period of time the twenty patients would, if they exhaled even naturally, vitiate fifty thousand four hundred cubic feet of air, which ought to be removed, and to be replaced by two thousand five hundred and twenty cubic feet of *pure* air for the use of respiration ; and then reflect whether it is probable that such a ward can remain during the whole night uncontaminated. For, granting to the twenty patients a breathing space of twenty-six thousand cubic feet, and even then it would require that the whole of the air in that space should be removed and replaced by fresh air fully twice in the one night. Against this, possibly, the artificial ventilating argumentists will urge that such a feat of ventilation is nothing at all, not worth considering, so easy to be done. M. Grouvelle would probably undertake to effect such interchange eight times in the night, or more ; and if he undertook to do it eighty times, and did not succeed in doing it once, it might be difficult to prove the fact against him. But if he would take a strip of paper prepared for ozone, place it in a ward, however artificially ventilated, and place another similar paper in the open air adjoining the ward, it is a mistake if he should not find that there was a striking difference in the process of oxidation in the two localities ; and that the great life supporter, oxygen, was in a condition

to play a very much more active part in its out-door than in its in-door work.

The misfortune of a great hospital, with all its rooms communicating indirectly with each other, is, that the ventilation is always uncertain. There is, in fact, no properly ventilated space except the great vault of heaven, and no true ventilating power except in the combinations of atmospheric pressure, wind movements, and the natural force of diffusion.

If special hospitals for consumptives are to be had, they should be as little colonies, situated far away from the thickly populated abodes of men, and so arranged that each patient should have a distinct dwelling place for himself. They should be provided with pleasure grounds of great extent, in which the patients who could walk about should pass every possible hour in the day; and with glass covered walks overhead, where the open air could be freely breathed, even if rain were falling. Very expensive such an establishment would be, there is no doubt; but it would be infinitely more advantageous, in a practical point of view, to treat ten patients in this manner, than ten tens in a confined brick and mortar box, through which of necessity some amount of invisible impurity, some trace of transparent poison cloud, is constantly floating.

The strongest argument in favour of consumption hospitals is, that they receive those members of the community who could not at their own homes afford the same advantages as are supplied to them in the charity. Against this it is to be urged that the patients taken into the consumption hospitals are *not*, in this country at least, in any way to be considered as the representatives of the most needy and destitute sections of the community. These latter go to their last homes

in the workhouse, or in their own poverty stricken dwellings. The classes that fill the hospitals are often many grades above destitution; and are sometimes comparatively wealthy. They have access to a governor who gives them an admission letter, and they leave their own medical adviser to enter the hospital, not because they cannot find the means to live at home and be treated at home, but because, catching at every new suggestion offered to them, they set their hearts on getting into the hospital, as though it were a certain haven of rescue. In this scramble after admission some of course succeed; they leave their homes, they enter the hospital, and there the greater proportion of them either die or return back to their friends nearer death than before. A few recover or are relieved; but whether the same result would have occurred, if they had been subjected to the same medical and general treatment out of the hospital? is a question which may be left very safely answered in the affirmative.

RULE II.

Active exercise is an essential element in the treatment of Consumptives.

The conditions for obtaining a due supply of air imply in some measure the necessity for exercise. But there are varieties of exercise. We have seen that Drs. Rush, Jackson, and Parrish are in favour of riding on horseback, but this is a thing not practically to be carried out in the majority of cases, and, as I think, not absolutely necessary. Walking is the true natural exercise, and the best, for it brings into movement every part of the body more or less, and, leading to brisker circulation in every part, causes a more active nutrition generally. The extent to

which exercise should be carried will vary with the stage of the disease, and temporary accidents may for the moment stop it altogether, such, for instance, as an attack of hæmoptysis. But when exercise is advisable, the general rule is to recommend that it be carried out systematically, cautiously, and courageously, and that each exercise should be continued until a gentle feeling of fatigue is felt through the whole muscular system. Violent and unequal exertion of the upper muscles of the body is unadvisable. When restored from the fatigue of one exercise, another should be undertaken, and during the day this cannot be too often repeated. If the day be wet, then the exercise should be effected by walking in a large room, or by engaging in some game, such as skittles, billiards, or tennis.

If, in his waking hours, the consumptive patient can keep himself occupied pretty freely in muscular labour, he secures the best sudorific for his sleeping hours that can possibly be supplied; for as the cause of force is always expended in producing motion or action, so, to use the words of Dr. Metcalfe, "the proximate cause of sleep is an expenditure of the substance and vital energy of the brain, nerves, and voluntary muscles, beyond what they receive when awake; and the specific office of sleep is the restoration of what has been wasted by exercise." Cough is very much less frequent in the course of the night in him who has been subjected to exercise in the day; while sleep, when it falls, is more profound, more prolonged, and more refreshing.

In summer time, when the temperature of the day is high, the morning and the evening time are the best adapted for the periods of out-door exertion. In the other seasons, mid-day is preferable, as a general rule.

I have sometimes been asked whether what are called gymnastic exercises are commendable in consumptive cases, and whether swinging is good. My idea on these points is that, in swinging, a person is much more usefully exercised when throwing the swing for his associates' pleasure, than in being himself swung. There is, in fact, but little faith to be placed in so-called scientific gymnastics. Anything that a man invents to overtop or compete with nature must needs be paltry. Brisk natural movement of the limbs is all that the consumptive requires. He need not go out of his way after a sham, in the shape of a shampooer; chopping wood is a good gymnastic feat, and playing at skittles is perfect in its way.

I have been asked too whether dancing is good exercise for children and young persons of a consumptive taint. There can be no doubt that it is so when properly conducted. When dancing is carried on, however, it must be done in a very large room, freely ventilated every way, and free from dust; for the more exercise the body takes, the more air it requires, and the less of incumbrances in the way of mechanical obstacles to a free respiration. In damp days, when walking out of doors is impossible, the consumptive child may thus have three hours dancing with advantage; not in stuck up bowing and scraping, finnickings, polite, quadrillism; but in good active country dances, that make every limb ache with fatigue.

The value of exercise is threefold. First, it checks waste of muscular structures, for muscles left inactive undergo a consumption, without any necessity for lung disorder. Secondly, it diverts the blood from the lungs, causes a more brisk circulation through them, and a more free distribution through

the system at large. Thirdly, it induces a more free respiration; more oxygen is taken into the lungs, the body is restored to its vital purposes more surely, and, just in proportion as this restoration is effected, so is the restoration of disordered function and of disorganised tissue.

In the performance of muscular exercise let the consumptive never encumber himself, or check the free movements of his body, by strappings, loads of clothes, carrying of weights, and the like. These are but tasks; they lead to unequal exertion in special sets of muscles, and such inequality of expenditure is that which is to be avoided. The treatment of consumption in a hospital is objectionable, again, in regard to exercise. Of what use to the consumptive is an acre or two of airing ground confined at the back of his hospital? Let him be certain that where the gardener cannot make roses bloom, and peach trees blossom, no doctor can give to the anæmic cheek a permanent colour, to a lost function its uses, or to an impoverished body its once healthy power.

A last consideration on the value of muscular exercise is, that it is eminently useful in keeping the respiratory muscles in a state of active nutrition. For, if to the loss of capaciousness in the lungs to receive air, there is added a daily increasing failure in the muscles by which the acts of inspiration and expiration are carried on, it is clear that a double evil is at work. Now this double evil is most actively presented in consumption. As the respiratory muscles, together with the other muscles, lose their tone, so do the general symptoms of exhaustion increase in severity; sometimes without very marked change in the pathological condition of the lungs. As a sequence, day by day, as the nutrition of these muscles de-

creases, and as they fail in tonic contractile power, they gain in excitability; so that the irregular spasmodic contractions to which they are subjected in the act of coughing are produced by the merest excitement, and the cough is more frequent as it becomes more feeble.

CHAPTER III.

HYGIENIC CODE, CONTINUED. RULES RELATING TO CLIMATE,
DRESS, AND HOURS OF REST, AS APPLIED TO THE TREAT-
MENT OF THE CONSUMPTIVE.

RULE III.

*A uniform climate is an important element in the treatment
of consumptives.*

CONSUMPTIVE patients are constantly asking questions as to the value of a change of climate. The poorest applicants for relief are anxious on this point, and are often ready at once to contemplate emigration, if the merest hope is given to them that such a course would prove beneficial. Several patients under my care have thus, while in the first stage of the disease, gone away, some to Western Australia, some to the South of Ireland, two to the Cape of Good Hope, and one to Valparaiso. Their fate I do not know. Patients sometimes have friends living in distant parts of the world, to whom they would like to go if such change of climate is recommended. In these cases I look at a map of the district, and obtain some geographical information regarding it before giving an opinion. Mr. Keith Johnston's *Physical Atlas*, and his paper on the "Geographical Distribution of Disease throughout the

Globe",* are documents of great value in this respect, since they give the physical characters of each country, and a history of its most prevalent diseases. In considering climate, the fact should be remembered that the main point to be obtained is to select such a part of the earth's surface as presents the nearest approach to an *equality* of temperature. Different writers of eminence have given the most contrary opinions on climate and consumption. Some have recommended a warm climate, others the polar regions. Both parties have spoken from experience, and they are, in some measure, both right; for a climate equally cold, and a climate equally hot, are each much more favourable than one in which there are constant variations, and where the thermometer in the course of the year dances about from many degrees below freezing point, up to 100° or more. Speaking of the mortality of consumption in 153,098 deaths between the years 1841 and 1851, the Irish Census Commissioners thus observe:—

“As might naturally be expected, the seasons exercised a very marked influence upon the deaths from consumption. During the mild months of autumn, succeeding the warm season of summer, the deaths attributed to consumption amounted to only 23,010; with the cold of winter the mortality from this cause increased, so as to present a return of 38,956; but with the harsh trying weather of spring it rose to 51,334, and in summer fell again to 39,798.”†

This statement represents a very important truth. It is certainly best for the patient, if the temperature, while

* For this paper, see JOURNAL OF PUBLIC HEALTH for July 1856.

† Census of Ireland for the year 1851. Report on Tables of Deaths, p. 448.

equal, is also temperate; but a mean temperature of 35° on one side, or 75° on the other, is preferable to one varying constantly, to-day at 60° Fahr., to-morrow at 40° , and a few days later at 80° .

In taking charge of a large number of consumptive patients attending for relief at an institution, it is a remarkable and highly instructive task to observe the influence of climatic changes in the symptoms of the disease. As each day comes for attendance at the Royal Infirmary for Diseases of the Chest, I can predict, almost with absolute certainty, what is the history I am to hear from the consumptives who are coming before me. If for some days there has been an uniformity of temperature, and the weather has been mild and dry, so that an airing each day out of doors has been effected, the visit is quite a cheery one; all seem better; the medicines are said to agree. The cough is less troublesome, the body is warmer, and hope, throwing an inward sunshine, lights up each face with brightness and activity. In frosty days, too, when the air is dry and the temperature continues even, the symptoms are often equally favourable; but during periods, so common in this country in the spring and in the beginning of winter, when the atmospheric variations are sudden, marked, and often repeated in the course of a few weeks, the general aspect of affairs is widely different. I have heard on these occasions almost every patient complaining; the symptoms are all exaggerated, the mind discontented. There is a general request for a change in the medicine. Something is asked for that will soothe, for the nights are passed indifferently. It is useless to comply always with these demands, since the exaggerated train of complaints has a general and common

cause ; but now and then the modification of symptoms is so great as to call for a modification of treatment. During these seasons of variation, deaths from consumption are most prevalent.

Thus an equable temperature is of great moment, and should always be sought after by the phthisical sufferer. If he cannot remove from his own locality, and if the variations in it are considerable, he must meet them by the best precautions at command. In-doors it is not difficult to sustain a pretty even temperature, varying from 50° to 60° Fahr. Out of doors, something must be done by attention to clothing, and by the use of the respirator. The most marked variations, however, occur in the night, and hence the importance of keeping up an equality of warmth in the bedroom, in the manner already described.

The reasons why consumptives feel the effects of climatic changes so much, are sufficiently obvious. The effects of such variations are felt, indeed, in the best health ; for the body is in some measure both a barometer and a thermometer, at all events it is subject to the same influences, the lungs being in all cases the parts most affected. With the temperature moderately high and the air dry, the physiology of respiration is carried on easily and well. The amount of oxygen taken in is ample, the expiration of water, carbonic acid, and ammonia is free ; the pulmonic circuit of the blood is unimpeded ; the exhalation of water from the skin is unchecked ; and the radiation of heat from the body is moderate. Let these atmospheric conditions suddenly change for those in which the temperature is 35° , or less, and in which the air is charged with watery vapour ; and the conditions of life are materially modified. The supply of oxygen

taken into the lungs is less ; the process of absorption of such oxygen by the blood is less ; the products expired are less ; the pulmonic circulation is impeded ; the watery exhalation from the skin is in part suppressed ; the radiation of heat from the body is much more rapid ; and, as a result of all, the whole man, body and mind, is reduced in force and in vitality. This is the course of things in a healthy man during atmospheric variations. It is left with the reader to trace out the exaggerated evil of these changes in those who, at the most favourable times, are existing with the lungs reduced in capaciousness and the respiratory muscles in power.

I shall recommend no particular place as a resort for consumptives ; for I wish not to enter into disputation on this point. But here is the formula for an hypothetical Atlantis for consumptives. It should be near the sea coast, and sheltered from northerly winds ; the soil should be dry ; the drinking water pure ; the mean temperature about 60° , with a range of not more than ten or fifteen degrees on either side. It is not easy to fix any degree of humidity ; but extremes of dryness or of moisture are alike injurious. It is of importance in selecting a locality that the scenery should be enticing, so that the patient may be the more encouraged to spend his time out of doors in walking or riding exercise, and a town where the residences are isolated and scattered about, and where drainage and cleanliness are attended to, is much preferable to one where the houses are closely packed, however small its population may be.

In speaking thus of the value of an equal climate, I am guided entirely by the facts daily presented to me in relation to climatic variations on patients living in or near London. Some authors, however, infer from mortality re-

turns, gathered from various quarters of the world, that variations of climate do not materially affect the disease. The following are Mr. Keith Johnston's remarks.

“Tubercular consumption cannot be said to be a disease peculiar to any one portion of the globe, or to be dependent on climate in any appreciable degree, unless it can be shown that it does not prevail in the excessive climates of the north. It originates in all latitudes, from the equator, where the mean temperature is 80° , with slight variations, to the higher portion of the temperate zone, where the mean temperature is 40° , with sudden and violent changes. The opinion long entertained, that it is peculiar to cold and humid climates, is founded in error. Far from this being the case, the tables of mortality of the army and navy of this and other countries, as well as those of the civil population, warrant the conclusion that consumption is more prevalent in tropical than in temperate countries. Consumption is rare in the Arctic regions, in Siberia, Iceland, the Faroe islands, the Orkneys, Shetlands, and Hebrides. And in confirmation of the opinion that it decreases with the decrease of temperature, Fuchs shows, from extensive data, that in northern Europe it is most prevalent at the level of the sea, and that it decreases with increase of elevation to a certain point. At Marseilles, on the seaboard, the mortality from this cause is 25 per cent.; at Oldenburg, 80 feet above the sea, it is 30 per cent.; at Hamburg, 48 feet above the sea, it is 23 per cent.; while at Eschwege, 496 feet above the sea, it is only 12; and at Brotterode, 1800 feet above the sea, 0.9 per cent. It is calculated that in the temperate zone, within which nearly all the civilised inhabitants of the globe are located, at least one-tenth of the population die of this malady. It is

uniformly more fatal in cities than in the country: in England the excess in cities is equal to 25 per cent."

But the facts here related are not opposed to the rule of climatic uniformity when carefully weighed. On the contrary, they go with the rule; for as consumption is most rare in extreme northern climates, and at great elevations, so in these localities are variations of climate less marked. It remains yet for statistics to show whether in more favoured patches of earth, where with the same absence of climatic variations there is a more genial but temperate warmth, the disease is equally prominent and fatal.

The Reports of the Irish Census Commissioners, already noticed, add, however, more force to the rule I have laid down, than any facts as yet published. The mortality from consumption in the spring months, for ten years, is there shewn to be twenty-two thousand more than in any other season. Why? Not, it is clear enough, because the months of spring are hotter than those of winter, or colder than those of summer; but because, in this transition season, the variations of climate are more severely felt. It is "the peevish April day" that tells, in its numerous changes, its cold mists, its warm sun, its heavy showers, on the constitution of the consumptive man.

RULE IV.

The dress of the consumptive patient should be adapted to equalise the temperature of the body, and so loose that it interferes in no way with the animal functions.

Instinctive sensations both in health and disease naturally dictate the above rule. But it is too commonly the fact that these sometimes are disobeyed. Some persons think it a hardy,

and therefore a beneficial plan to dress lightly in all weathers. Foolish mothers send out their children in midwinter with bare legs and chests; young ladies go to balls and evening parties with the upper part of their dresses open, to show off more effectually a finely chiselled throat and bosom. A lady hints to me that this is the custom of society, not the vanity of the sex. Admitted, madam, out of courtesy; but is society to have its victims from the innocent? It has enough, surely, if it has them from the wicked only. Others go on a different tack; they must at all seasons be smothered up in flannels and outer dresses, layer upon layer, carrying in short as much cloth as they possibly can, like a full sailing cutter. Such persons on both sides evidently misunderstand the uses of clothes, or think them only ornamental appendages. But clothes are useful, in a sanitary point of view, simply as equalising temperature, *i. e.*, for preventing more or less the escape of the animal heat as it is radiated from the external surface of the body. Heat is transmitted slowly through flannel, so flannel is warm. For this reason, some say that flannel should be worn in summer as well as in winter, because in winter it retains the animal heat, and in summer it prevents the external heat from oppressing the body. The last part of this argument is a mistake, as experience teaches. For the body does not get its heat from without but from within, and the course of the heat is always from within outwards into space. If, therefore, as occurs in summer, the body cannot barter its heat freely enough to the warm air which surrounds it, it becomes hot; but surely it is no good policy to prevent such radiation as would go on, by interposing a layer of flannel between the body and the air. A loose flannel outer dress may be passa-

ble in hot weather, because the air circulates freely beneath it; but a closely fitting flannel underdress is just as unnecessary in this case, as it is necessary in winter when the air robs the system of more heat than can be conveniently spared.

I speak here of the body in health. In the consumptive patient, the principle is modified. He, from the deficient play of his lungs, is virtually always living in winter; and you shall find him on the hottest days breathing with anxiety, and with his hands and brow cold as marble.

For the consumptive, therefore, flannel clothing is always required, and it should cover the whole of his body. The poorest man or woman may avail themselves of this, for it matters little what the outer garments are if the under ones are non-conductors of heat. The thickness of flannel must vary according to the sensations; as far as is possible, the feeling of absolute cold ought to be at all times prevented. The consumptive should sleep also in flannel; not in the dress worn during the day, but in a flannel gown. The shoes worn should be thick, whole, and comfortable. All sorts of absurdities in the way of hair skins, warm plaisters, and the like, placed specially on the chest, are useless; and the plaister is worse than useless, since it checks the function of the skin over a considerable surface, and is dirty.

A common practice in the selection of clothes is to imagine that the weight of a garment conveys an idea of its warmth-sustaining power. This is an absurd error; for what is warmer than a German coverlet, which is simply a silk bag half filled with down, and nearly as light as air? For consumptive persons, this mistake about heavy clothing must be carefully avoided; they may safely trust to flannel, and may then walk out as warm as they can be made by clothing,

without the risk of being wearied from the burthen on their backs before they have got half a mile from home.

There is one modern article of male attire, on which a word of caution must be said, for its bad effects are unmistakeable. I must warn men in general, and consumptive men in particular, against wearing what are called waterproof India rubber coats. That these intolerable nuisances are very tempting there is no doubt; they are light; they are rain-proof; and are they not reversible, two-faced, so that one may be transformed by them, in half a minute, from the similitude of a cabman into the representative of a very spruce gentleman? But let any one walk in one of these portable bathing machines, with the shiny side inwards, for an hour or so, and at a brisk pace; and, when he has finished his journey, let him look at the shiny side within, and feel the hygrometric state of his under coat; and if he does not find that there is such a thing as getting wet through without rain, and that anything preventing a drenching of the body from without is certain to check the exhalations from the skin, he must be very blind to the defects of the reversible. The healthy man may tolerate one of these garments; the consumptive, never. They load the under clothes with moisture; they give a cold envelope to the surface; they produce chill; and, by checking the cutaneous function, they throw a double amount of work on lungs already failing under their ordinary duties.

Is it necessary to more than mention those abominations of female attire, corsets? I hope not. However, as some young ladies are still led to imprison themselves in them, it may be well to tell the mothers of such, that to screw up a consumptive child's chest with stays, is only equivalent to preventing the act of breathing by the mouth, because it was performed with difficulty by the nose.

Whenever the question is asked of the female patient, why do you wear stays? the answer invariably is, "because they afford support; it would be impossible to walk upright without them." This of course is mere childishness, the expression of a whim engendered by the long continuance of a foolish habit. If a lady would only consent to take herself out of stay imprisonment for one week, the sensation of want of support would be felt no longer. Speaking on this point, Dr. Gregory, in his work entitled *A Comparative View of the State and Faculties of Man, with those of the Animal World*, a work written nearly a hundred years ago, but which would amply repay its republication in these days, thus remarks:—

"Some nations have fancied that Nature did not give a good shape to the head, and thought it would be better to mould it into the form of a sugar loaf. The Chinese think a woman's foot much handsomer if squeezed into a third part of its natural size; some African nations have a like quarrel with the shape of the nose, which they think ought to be laid as flat as possible with the face. We laugh at the folly and are shocked with the cruelty of these barbarians, but think it a very clear case that the natural shape of a woman's chest is not so elegant as we can make it by the confinement of stays. The common effect of this practice is obstructions in the lungs, from their not having sufficient room to play, which, besides tainting the breath, cuts off numbers of young women by consumptions in the very bloom of life. But Nature has shewn her resentment of this practice in the most striking manner, by rendering above half the women of fashion deformed in some degree or other. Deformity is peculiar to the civilised part of mankind, and is almost always

the work of our own hands. The superior strength, just proportions, and agility of savages, are entirely the effects of their hardy education, of their living mostly abroad in the open air, and their limbs never having suffered any confinement."

Not less injurious than stay wearing, is the practice of placing a strap or belt round the waist, tightly buckled, for the purpose of securing a delicate slenderness in mid-body. It is monstrous, this system—positively slow suicide. Yet, in making stethoscopic explorations of the chest in female patients, one is constantly detecting these tight buckled instruments of torture. In the bad old times, mad ascetics wore the tight strap as a penance for sin. This was the true original function of the article ; now it is worn by unfortunate soldiers and deluded girls, as a punishment which they owe to the laws of society, apart from the idea of sin penance altogether.

There is yet another bandaging, tight bracing folly, on which a word of earnest remonstrance must be said ; namely, the swathing band process which unpardonable ignorance inflicts on the new-born child. Scarcely has the infant informed its friends by its loud proclamations of its safe arrival in this little world, than an old woman in the shape of nurse (it were well if Professor Owen had all old nurses in the Crystal Palace garden amongst his extinct friends) begins carefully to roll up the poor innocent in six yards of three-inch calico, as though she were an Egyptian embalmer, and were preparing an exquisite mummy. If she bound up the legs of the child, the mischief would be less : but not at all ; she binds up the body, and thus from the first day of life cuts off half the force of respiration. Mothers of the new-born, be-

lieve me that this practice, even in the person of the strongest child, is as cruel as it is insane. Believe me that if dame Nature, who is wiser than you, had intended your child to receive this abdominal support, she would have provided the bandage herself. But if you will not believe me, hear what Dr. Gregory has to say on this subject.

“All young animals naturally delight to be in the open air, and in perpetual motion : but we signify our disapprobation of this intention of Nature by confining our infants mostly in houses, and swathing them from the time they are born as tightly as possible. This natural instinct appears very strong when we see a child released from its confinement, in the short interval betwixt pulling off its day clothes and swathing it again before it is put to sleep. The evident tokens of delight which the little creature shews in recovering the free use of its limbs, and the strong reluctance it discovers to be again remitted to its bondage, one should think, would strike conviction of the cruelty and absurdity of this practice into the most stupid of mankind. This confinement boys, in some degree, are sooner released from ; but the fairer part of the species suffer it, in a manner, during life.”

“The Siamese, Japanese, Indians, negroes, savages of Canada, Virginiæ, Brazil, and most of the inhabitants of South America, do not swathe their children, but lay them in a kind of large cradle lined and covered with skins or furs. Here they have the free use of their limbs, which they improve so well, that in two or three months they crawl about on their hands and knees, and in less than a year walk without any assistance. Where children are swathed, or so closely pinioned down in their cradles that they cannot

move, the impulsive force of those internal parts of the body disposed to increase, finds an insurmountable obstacle to the movements required to accelerate their growth. The infant is continually making fruitless efforts, which waste its powers or retard their progress. It is scarcely possible to swathe children in such a manner as not to give them some pain; and the constant endeavour to relieve themselves from an uneasy posture is a frequent cause of deformity. When the swathing is tight, it impedes the breathing and the free circulation of the blood, disturbs the natural secretions, and disorders the constitution in a variety of ways. If a child is pinioned down in its cradle in such a manner as prevents the superfluous humour secreted in the mouth from being freely discharged, it must fall down into the stomach, where it occasions various disorders, especially in time of teething, when there is always a very great secretion of this fluid. Another inconvenience which attends this unnatural confinement of children, is the keeping them from their natural action and exercise, which retards growth and diminishes the strength of the body. It is pretended that children left thus at liberty would often throw themselves into postures destructive of the perfect conformation of their body. But if a child ever gets into a wrong situation, the uneasiness it feels soon induces it to change its posture. Besides, in those countries where no such precautions are taken, the children are all robust and well proportioned. It is likewise said, that if children were left to the free use of their limbs, their restlessness would subject them to many external injuries; but though they are heavy, they are proportionably feeble, and cannot move with sufficient force to hurt themselves. This, however, is the true source of the wretched slavery to

which they are condemned. A child whose limbs are at liberty must be constantly watched, but when it is fast bound it may be thrown into any corner.”

The wisdom that may be learned from these observations, is applicable to the management of children generally. Its more important application to children of consumptive birth is obvious.

RULE V.

The hours of rest of the consumptive patient should be regulated mainly by the absence of the sun.

If exercise is important to the consumptive patient during the day, a due allowance of sleep is equally necessary during the night. The natural hours of sleep are from sunset to sunrise, and it is the business of the consumptive to make nature his oracle. Shakespeare has happily said that sleep is the “chief nourisher in life’s feast”, and Menander held that it was “a remedy for every curable disease”. The great use of sleep truly is to renovate; for in the sleeping state the formative processes go on most actively. Metcalfe, to whom I before referred, has well defined the difference between exercise and sleep, by saying “that during exercise the expenditure of the body exceeds the income; whereas during sleep the income exceeds the expenditure.”

It is obvious that to the consumptive man nothing can be more important than that his income should alternately and at natural seasons exceed his expenditure; and it is quite remarkable how much alleviated all the symptoms of consumption are when the balmy god is appealed to not in vain. The rule I have laid down regarding the hours for sleep is imperative for many reasons. First,

because in all seasons the actual amount of rest required by the natural man is pointed out with the precision of an astronomical law by the course of the sun. In midwinter men require, for physiological reasons, more sleep than they do at midsummer, and just so much more as is indicated by the difference of night in these two periods. Observe how all animals, left to their own natural instincts, obey this law. Secondly, in our present artificial mode of life, we have to extend the day by the invention of artificial lights. But whenever a man shuts himself up in his closet, and makes a little sun out of his gas lamp or candle, he is feeding that lamp with a part of his own breathing store—the air around him. Worse still, the candle can, no more than the man, live alight without exhaling carbonic acid gas, and thus vitiating the atmosphere. A pound of oil burnt in a lamp produces, in burning, nearly three pounds, and every cubic foot of coal gas, rather more than a cubic foot of carbonic acid. The evil effects of carbonic acid on the lungs have been already described. Thirdly, as an artificial light is, by the mode in which it is produced, of necessity injurious, so, on the contrary, the pure sunlight is of the greatest worth in the acts of vitality. What sunlight does in a physiological way is undetermined; but its general influence has long been known and recognised. Plants banked up from the light become blanched, and human beings kept for a long time in dark abodes become the victims of anæmia and scrofula.

Thus, to fulfil the natural law regulating the times of sleep, to escape from the artificial light, and to obtain the advantage of all the sun-light that can be secured, the consumptive patient should make the sun his fellow workman.

During the act of sleep many physiological modifications

occur, which it is important to notice. In the sleeping state the number of respirations are diminished and the circulation is more feeble; as a result, the temperature of the body is reduced. These facts supply two indications, viz., that a free supply of air must be given to the sleeping man, and that he must be well enclosed in woollen material, so as to husband his animal heat. The profuse perspirations, which form so marked a symptom in the phthisical generally, come on during a profound doze, and the patient wakes to find himself bathed in moisture. It always occurs to me, that this profuse action of the skin is but secondary to, and consequent on, a diminished exhalation from the lungs. At all events, after having tried oil inunctions, sponging with acid solution, and the administration of various astringent remedies, with varying success, I have found no plan so efficient for preventing these perspirations as that of supplying a constant current of pure air. This system does not, of course, interfere with the application of other remedial measures, but it should stand foremost. Cough also, so common a disturber of the night's repose, is most effectually treated on the ventilation principle. For an impure air excites cough by its direct effect on the mucous surface of the air passages; and further, as before shown, when air laden with carbonic acid is inhaled, the chemical changes of respiration are checked, the pulmonic circuit is retarded, the heart becomes embarrassed, and congestion of the lungs is an inevitable result. This is another exciting cause of cough and expectoration.

As soon as the patient has risen, he should at once leave his bedroom; and, if the morning be fine, he should go into the open air. On this point Mr. Bodington, in a short essay

On the Treatment and Cure of Pulmonary Consumption,* published in 1840, dwells with great force. "The profuse nocturnal perspirations are soon subdued," says Mr. Bodington, "by this method of treatment, and the debility they occasion avoided. The skin assumes a healthier action in proportion to the extent of exposure to the external atmosphere, particularly to the morning air."

In large towns the practicability of this last suggestion is less than in the country ; but even in London life, an early morning walk should be made a matter of strict business by the consumptive. On a fine summer morning, between three and four o'clock, a walk through the streets and squares of London is, indeed, a treat which few Londoners understand. The air is free of smoke ; the thoroughfares are royal unimpeded highways ; and, while the great population sleeps, the magnitude of its residence is best seen and understood.

* I was unfortunate in not having become acquainted with Mr. Bodington's essay when the first pages of this work were written ; and the mention of him was, therefore, most unintentionally omitted in the opening chapter. I may add, now, however, that Mr. Bodington's views are very ably expressed, and indicate both originality and vigour of thought.

CHAPTER IV.

HYGIENIC CODE CONTINUED. RULES RELATING TO THE
OCCUPATIONS, AND THE AMUSEMENTS, TO BE FOLLOWED
BY CONSUMPTIVE PATIENTS.

RULE VI.

The occupation of the consumptive patient should be suspended if it is in-door or sedentary; but a certain amount of out-door occupation may be advantageous.

THIS rule is most difficult to carry out, in the majority of cases. At the same time it is second to none in importance, as there is, in a word, no exciting cause of consumption so general as in-door occupation. I remarked some time ago that about two out of every three patients with consumption, who presented themselves before me at the Infirmary, were found on inquiry to be employed in some in-door business. This was confirmed accurately by reference to the Infirmary books, the figures of which have been very carefully analysed for me by Mr. Pring, a student and assistant at this institution.

Of late, the occupation of every patient applying for relief has been noted down; and since this plan was commenced, there have been at the Infirmary five hundred and fifteen cases of consumption, under the treatment either of my colleagues, Drs. Davics and Powell, or under my

own care. From the pains that are taken in diagnosis in each of these cases, they may be all received as representing real instances of the disease, in one or other of its stages. Out of these five hundred and fifteen cases then, not less than 68·34 per cent., or rather more than two-thirds, have been persons following in-door occupations. Possibly the per centage is even higher, for all who have called themselves labourers have been presumed to be out-door workers, although this may not have been always the fact, since many labourers in London are employed in vaults, in warehouses, and in gas-works. Among the in-door occupations which present the largest number of cases in this list, boot and shoemakers rank first; needlewomen second; watch and clock-makers third; domestic servants fourth; painters fifth; tailors sixth; printers, of whom the majority are compositors, seventh; bookbinders eighth; French polishers ninth; cigar-makers tenth; writers eleventh; smiths twelfth; tinmen thirteenth; and cabinet-makers fourteenth. There are altogether in the list one hundred and forty trades specified, but the above named fourteen yield rather more than forty-four and a half per cent. of the whole.

I am aware that five hundred and fifteen cases, however carefully selected, are a small number from which to draw any very large conclusions; and I regret that the table of occupations and diseases given by the Irish Census Commissioners is too general and vague, in its application of terms, to admit of its being used in this place. But of the fact of the great preponderance of consumptive cases amongst persons who live in a confined space, there can be no reasonable doubt.

As adding to the truth of this argument, my friend Mr.

Cox, of Wigan, has forwarded me an analysis of a hundred cases of consumption, occurring amongst the out and in-patients of Charing Cross Hospital, during the years of 1846, 1847, and 1848. From Mr. Cox's tables, it appears that, out of the hundred cases, sixty occurred in persons following some in-door work ; that in twenty-one of the cases the occupation was not given ; and that the remaining nineteen are instances where the disease manifested itself in persons following out-door employment.

In the case of parents having children of a consumptive tendency, therefore, the greatest care should be taken to obtain for them out-door employment. But here a serious delusion commonly come into play. If the child is weakly, the fond parent urges that it is unfit for hard labour and for out-door vicissitudes ; so it is sent to a tailor or shoemaker, to a clerk's office, a draper's shop, or to some occupation of an in-door character ; by this grand, ignorant, and fatal mistake, it is added to the list of the two-thirds who swell the tables of consumption cases.

In many in-door occupations a double mischief is at work. The patient is not only confined in an impure air, but is made also to inhale some foreign agent, present of necessity from the character of his work, and with which the air is charged. I cannot here enumerate the substances which the lungs thus draw in ; they are as various as trades themselves. Sand and glass, in the sand-paper manufactory ; dust and fluffs of different kinds in textile manufactories ; acid vapours in dyeing establishments ; naphtha and turpentine vapours in polishing and burnishing shops ; particles of the metal in the steel grinding shop ; coke vapour in the tin-plate working establishment ; these are but a few examples.

Whenever a consumptive patient following an in-door occupation comes under treatment, he or she should be advised either to leave it or to modify it. Some occupations, such as cigar making, sand-paper making, and fur dyeing, are absolutely fatal, and it is hopeless to treat medicinally the patient who continues to follow them. But in other trades, where no mechanical mischief is being done to the lungs, and where the evils mainly are those of confinement in a room and want of exercise, very much can be done by ventilation, and by getting the sufferer to give up a portion of every day to a long walk in the open air.

But here, in the treatment of consumption amongst the working classes, serious social difficulties stand in the way, and offer cause for deep reflection and pain to the physician. The majority of individuals amongst those classes have no alternative but to work, work, work, so long as their exhausted bodies can sustain even a remnant of the daily task. A poor fancy box-maker came before me in September last, a girl just passing into womanhood. She was in the first stage of phthisis. The out-door life was named to her as the most potent remedy. It was hopeless advice. With streaming eyes, she told me that I might as well advise her to enter the charmed circle of high life. "You might as well tell me to become a duchess"; work or starvation was her alternative. "I have no friends", she said, "and know no other occupation or mode of subsistence. I work from eight in the morning to eight, and sometimes to twelve, at night, in a close room, with a dozen more workwomen; but to lodge a complaint against the occupation, the hours of work, or the closeness of the room, would be to lose everything; for my employer pays well, and bears no interference; to ask even

for an hour or two in the day, were to ask for a dismissal altogether." "Will a certificate from me do any good?" I inquired. No; it was a kind proposition, but she dare not avail herself of it; the alternative was, as she had said, "to work or to starve."

I have lost sight of this unfortunate now. She has gone on, I doubt not, as many have done before her, getting worse daily and hourly, until at last, feeding on one of the causes of her disease, some hospital or workhouse has received her, the period of her recovery being long since past.

One out of a hundred instances is this; but I put it forward with a query to the charitable. I want to know whether charity, so inestimable an English virtue, might not stretch out its hand to help the consumption-stricken poor in the dilemma above described? Could not the wealth of this great metropolis raise some little colonies out of town, where the class of consumptive persons who have to live by their own handiwork could find a home in pure air, and an occupation suited to their malady; nay, where industry might be turned to a double use—the obtaining of a livelihood, and the hygienic treatment of the disease?

Again, I find that many workmen suffer from the effects of their trade, without being at all conscious that such is the fact. The trade is so light and so simple, that its injuriousness is concealed. A walking-stick-maker came before me lately. "Do you suffer from your trade?" was the usual inquiry. Well, he was not aware that he did; but of course the "powder made him cough." It turned out that "the powder" was charcoal dust. When walking-sticks have been shaped and dried, they are charred over coke fires, then scraped, and finally are shaded off to various colours with

sand-paper. This process is carried on in a closed room ; and the men consequently are drawing in, for hours daily, the fine particles of the charred wood. The man I refer to owed, as I believe, all his symptoms to this inhalation. He succeeded in leaving his work for a time, and recovered in a remarkable manner. He returned to his work, and his disease returned to him. Of late this man has not made his weekly call ; for he obviously grew tired of my constant advice against his occupation. With him, too, work or starvation was possibly the alternative ; so, hoping to be cured of his symptoms in the face of their leading cause, he has consulted some other one of the Esculapian brotherhood.

Lastly, some sedentary occupations beget a habit of muscular inactivity. Unworked machinery always resumes work lazily : and muscles long left to a passive nutrition, respond slowly to the dictation of the will. The physical conquers the mental force. Hence some patients cannot be persuaded to give up their inactive pursuits, even when they have the opportunity to do so. To prescribe a walk of two miles per day to these individuals is felt a cruelty. Nor are these difficulties met with only in anæmic young girls, bleaching in millinery establishments, or in no establishments at all. They extend to men of various sorts ; men of letters, men given up to sheer indolence, and to sedentary workmen—particularly watchmakers, shoemakers, and tailors.

On the other side, almost all occupations implying muscular exertion out of doors, without undue exposure to wet and damp, may be pursued by the consumptive as long as possible, and with advantage. The pursuit of some occupations is, indeed, better exercise than simple walking, since it keeps the mind occupied and in healthful tune.

I remember a patient once who, in the first stage of consumption, insisted on coming into town each morning from a considerable distance in the country, to look after his business, and to return home again in the afternoon. It mattered not that the sky looked threatening, for he was not afraid of such a trifle, although he knew that the plague-spot was in his breast. When expostulated with by friends (and, I am ashamed to say, by myself, for I was ignorant then of the truths I now state), his reply was, "My brothers and sisters have all died of consumption; they were coddled up, nursed, carried about, confined to bed, and bound in the cords of helplessness by the kindest hands, to the satisfaction of the doctor and of all concerned. But they soon died. I hold the germs of the same disease, and I too shall die; I know it; but my course is different, for I have made up my mind to die in harness; I have kept at my business in resistance to all entreaties, and I am the only one of the family left." The plan adopted by this man was right; he bore the brunt of the disease for months, and, to the best of my knowledge, he is alive, and occupied still.

I recommend every consumptive, whose occupation is in the open air, to take to heart the motto of this man, to make up their minds "to die in harness". They will live the longer for the resolution.

At the same time, as there is a medium in all things, so is there in reference to exercise. Excessive and violent muscular fatigue is next door in injuriousness to complete muscular inactivity; and it is remarkable, in looking over tables of the occupations of consumptives, to find that amongst those who are reported to have been occupied in out-door work, the majority have belonged to pursuits which imply an *ex-*

traordinary muscular expenditure. Hence, in such records, "labourers" rank high; for under this head is included that extended circle of human beings which, in regard to everything that is laborious and exacting, is linked to the dray-horse by closer affinities than any that elsewhere exist between man and brute.

RULE VII.

Excessive mental exertion should be scrupulously avoided by the consumptive.

It is the fate of some members of the human family, who are of consumptive taint, to have minds of a very active and laborious character. As children, these love reading, and pursuits of an intellectual kind. They are specially precocious; and admiring parents, with proud hopes as to the future of their offspring, encourage an exertion which ought ever to be kept in bounds. As these precocities grow up, their minds' development runs out of proportion to the development of the body. On this, muscular labour becomes a bore, and the study or desk the only enjoyable place in life. The result is, not that the mind by its over work directly wears out the body, but that the body is neglected, and its physical degeneration hastened.

This mental overstrain, unhappily too often seen, is beyond all expression unwise. It is unwise, because it defeats itself. Man was not made to be a sitting animal, with his head buried in his hands, in solemn meditation on things and concerns which he will not step out of doors to look at, and therefore cannot know from aught but theory. It is unwise, because it destroys health, and, by shortening life, shortens labour. Still more, it leads almost inevitably to another

habit in the contemplative student; that, namely, of sitting up in the late hours of night, burning away in the company of the midnight oil. Now all noise is hushed; thought is concentrated; the fevered cheek is flushed; the hand works tremulously; while the feet, with a diversion of blood from them, and unoccupied, are half dead with cold. In the excitement of these moments respiration is irregular, and the heart beats out of time, this minute slow and languid, the next tumultuous and palpitating. These are the moments of "deep inspiration". The "inspired" would be much better in bed, with his mind and heart in equal quietude; and (I must be commonplace) his toes warm.

At last, worn out, our studious martyr goes to his couch, but not to sleep. Muscles overwearied, as every man knows who has been on foot all day, will not lie quiet at a moment's notice: "I am too tired to sleep", says the wearied man. Neither will the mind, relieved from the pressure of a long strain, sink at once into composure. Therefore the remainder of the student's night is restless; there are flatulency, coldness of the surface, hysteric feelings, a copious and often repeated excretion from the kidney; and, worse than all, a sensation, as each attempt at sleep arrives, that the heart is stopping. Straightway the element of fear comes into force, and all forms of delusions, and horrors of sudden death, seize the disobedient disturber of nature's divine law. He cannot lie; he must get up, drink water, open the window to look at the stars, or restrike his light to make a vain attempt to read some light work. When the sun is beginning his round, sleep at last comes; and then, in spurious rest, half—the best half—of the day is lost, in order that the body may be imperfectly recruited for the perpetration of a repetition of

that folly of follies, a long living dream of deep thought and memory, in an unwholesome atmosphere.

The bad effects of this disobedient conduct show themselves first, according to my observation, in derangement of the digestive system ; and with men of sound constitutions originally, and of strong build, with full sized active brains, and large chests and stomachs to support the mind's treasury, it often happens that the symptoms induced are for many years those of indigestion only, and in the end are rather directed to affections of the heart or brain (organs which not unfrequently wear out together) than to the lungs. But in young persons of consumptive taint, the impaired nutrition of the whole body, incident to the impaired digestion and broken sleep, tells speedily on the respiration, and supplies the elements of the fatal disorder. Let me therefore beg the consumptive youth, engaged in pursuits of a mental kind,—whether these be conducted in the counting-house, the private study, or the college,—let me beg him, as a friend rather than a physician, to remember what is written above ; to recall the sensations which I have tried faithfully to describe ; and, as a practical deduction therefrom, to write his own doom less speedily. Let me beg him to obey the law ; to go to bed at early times ; to give himself up ten hours nightly to the companionship of the slumber-god ; to work at brief intervals only, when his mind is in tone ; to exercise his vile muscles as well as his elegant brain ; to breathe for some eight hours out of the twenty-four the unrestrained air ; and to let all the absurd poetry about “ those dying young whom the gods love ” go its way. The gods love and help those who love and help themselves—none else ; and these die *old*.

I have seen so much mischief arise from the overwork of

the mind, in consumptive children and youths, that I have dwelt no longer than is really necessary in treating on the importance of the present rule. If I had a child of decidedly consumptive tendency, he should scarcely touch books at all. He should be taught orally as much as possible ; he should be brought up in the open air, and to out-door pursuits and occupations ; and he should be encouraged to enter into every innocent game where the muscles are brought into vigorous play. In short, I would prefer rather to be thought a harsh preceptor, than to be called a kind one for introducing the coddling process, and for supporting on all occasions the mother's general and loving plea, that the poor thing is too weakly to be separated for many minutes at once from her apron-string supervision.

A medical friend of mine, a well known practitioner, is blessed with a family quiver as full of arrows as it can possibly stick ; children twelve in number. These, he tells me, are all entitled to consumption ; for their paternal uncle and great uncle, and their two maternal uncles, all died of it. But not one of these children has ever exhibited a phthisical sign ; for their intelligent father makes "grooms" of them ; they have been constantly with him in his rounds in an open chaise, in all weathers ; they have been made to live three months annually in the country ; when at home, they spend half the day about Primrose Hill ; and, though their education is carefully attended to, they have never been allowed to pore over books.

This is an instance of the value of a rational practice in the treatment of those who are predisposed to this disease. If it were an isolated instance, it would be open to objection. But it is not isolated. It would be easy to fill page after

page with similar illustrations, and all supporting the rule now urged with so much stress on the attention of the reader.

Of the occupations suited for consumptives, the seafaring life is by no means the worst. The position of a travelling agent is good, as is that of the land surveyor and the farmer. The rule, however, for the choice of an occupation, is best followed out by adopting the exclusion process. Exclude every calling in which close confinement to the study, the shop, the counting-house, or any other house, absorbs the greater part of the worker's life.

In the change of climate for consumption, the good that arises is as often dependent on the exposure to air, and to the exercise necessitated by the travelling, as on the transition to another air. At the same time, as before shewn, an equable climate is a most valuable adjunct in the treatment of phthisis.

Every occupation, moreover, will be modified with advantage by the enjoyment of ennobling pleasures. The dance is good in its season, the lecture lesson is to be recommended, the drama, and the music room. But these pleasures are with difficulty attainable without injury to health. The theatre is an unventilated oven; the lecture hall is often cold, and charged with unremoved air; the concert room, like a lighted up and gilded "black hole", is closely packed with living, but assuredly not moving beings.

From all these crowded assemblies I warn the consumptive to keep away. The pleasure derived from them is nothing in comparison to the physical mischiefs insured in obtaining it. It may be well to consider a few of these points relating to amusements under a distinct rule, and with some degree of care.

RULE VIII.

The amusements of the consumptive should be so selected as to favour muscular developement, and sustain a healthy respiration.

The outdoor amusements of consumptives should be such as lead to active muscular exertion and free exposure to a pure air. The indoor amusements should partake of the like character, as far as possible. Billiard and bagatelle playing afford each good exercise; dancing does the same, when carried on with some regard to the state of the individual who dances. As to balls and late evening parties, as places of resort for consumption-stricken men and women, I can only say of them, that they are a direct bar to recovery, and that it is less reasonable to treat young ladies and gentlemen who, for the sake of society, frequent such entertainments, than it is to treat the poor cobbler who, for the sake of his wife and family, sits all day, like an animal undergoing a physiological experiment, in a closed glass-case four feet square, fixed into a hole in the wall of a dwelling-house: a sight not unfrequent in the streets of London. To the ball, indeed, the phthisical might well apply the saying in Queen Elizabeth's confession: It does those things which ought not to be done, and leaves undone those things which ought to be done; and there is no health in it.

Here are the evils of balls and evening scenes.

a. They lead to late hours and broken rest.

b. They secure the inhalation of an air charged with human and lamp exhalations, and often with dust.

c. They afford no healthy exercise, because exercise taken

in a bad air is no exercisc at all; *i. e.*, it does not assist to rebuild or recruit the body.

d. They produce an unnatural and empty-headed excitement, which leaves the body so prostrated afterwards, that hours, or even days, are required to recover from it.

e. They lead the poor victims of fashion to go clothed in a manner grotesquely absurd, and in garments so arranged that the equality of temperature of the body over all its surface cannot possibly be sustained; while in the transition from the carriage to the ball-room, and back again to the carriage, exposures to sudden alternations of temperature, not unfrequently varying from 30° to 60° or 70° Fahr., are necessarily encountered.

f. The refreshments of the ball-room are utterly out of place. In proportion as they are delicate and elegant, so are they mischievous. Wines, ices, sweets, jellies, at twelve o'clock at night, for a delicate girl just "out"! How will she sleep after this? how will she wake next morning? how will she languish through the next day—nauseated, pale, and lifeless?

If, in these expostulations with the public at large, I am not more successful than I have been in expostulations with private patients on this important point, my labour is hopeless enough, and in vain. In the matter of fashion and its absurd allurements, the most common-sense persons in other affairs seem veritably insane. Yet, national health is national wealth; and the social advancement of mankind is intimately connected with physical development. If the Anglo-Saxon race is ever doomed to fall from its high estate, the historian of the event will have to trace the decline to but one main source—a physical degeneration, induced by an ignorance

of the meaning of life and its phenomena, and by the sacrifice of health to sensual pursuits and to the luxury of idle follies. The imbecility of elegance is the worst fate that can await any man, nation, or race.

As I have before shown, dancing in a well ventilated room, and at seasonable hours, is a most useful exercise ; and this and other refined amusements are not to be neglected because they may be abused.

Music has a grand influence on some minds, and may be cultivated with advantage under due regulations ; but upon wind instruments the phthisical man should not exert his skill. The exertion of blowing these instruments interferes materially with the regular play of the respiration and circulation. In playing upon stringed instruments, moreover, the amusement should not be carried on until it wearies the performer. Mothers anxious for the accomplishments of their daughters make frequently a fatal mistake on this score. They place a poor child, who has no musical tastes, at the pianoforte ; and there she is made to sit hour after hour, until a lesson is perforce learned, or an exercise completed. The system is useless in an educational sense ; while, as regards the health, it is fraught with direct danger.

For the consumptive, reading aloud is a good daily practice. Cuvier, the great naturalist, attributed his recovery from threatened phthisis to the delivery of some lectures which he was appointed to give. There should, of course, be a limit to the time of reading aloud ; it should on no occasion exceed an hour, and should be stopped before that if hoarseness or weariness supervene ; it should be done also without effort or vociferation.

The selection of books for the mind's entertainment is

further an important point. Exciting romances, filled with the narrations of deep and fiendish plots or hyperpoetic sentiments, are quite out of place, for they, through the mind, influence respiration to the detriment of the physical forces of life. So also do dull, monotonous, whining, terror-striking treatises, of whatever kind. But the book which is amusing, and with easy effort raises the hearty laugh at an innocent picture; or the book which carries the reader along the page of history with gentle carriage, or tells of natural facts in natural language,—this is the book to be sought for. The pages of Dickens, Thackeray, Cooper, and Hood, of Macaulay, Grote, Washington Irving, and Bancroft, of Longfellow, Tennyson, and Mackay, and, let there be no omission, of immortal Mr. *Punch*, who is not only the merriest, but one of the best and wisest representatives of his age, and who, for his soundness in physic, deserves, by the Archbishop's grace, at least the Lambeth M.D.: the works of all these great writers offer, I say, the choicest modern specimens of secular readings that a life-depressed man or woman can take in hand for healthful entertainment. I say nothing of theological works; the body's welfare is my care. To the wisest, the least melancholy, and least bigoted of the clerical profession, the rest pertains.

Singing is an amusement which may with prudence be followed by the consumptive in whom the tendency to the disease is indicated only, and the disease itself is not actually developed. The exertion must not, however, be kept up so long at any given time as to produce breathlessness or hoarseness. It must be done without labour or distress, and at intervals when the body is in a condition to sustain the effort. It is then useful.

Amusements which lead to great mental exertion without exercise, such as chess, should rarely be indulged in.

When, in a previous page, I dwelt so strongly on the value of muscular exercise in consumption, I should have claimed exception to one muscular amusement, viz., boat-rowing. This exertion is too laborious and special, and inflicts serious penalties on some of its votaries. Dr. Latham has treated of this amusement in reference to its bad effects on the heart and circulation. His remarks are of great value. The same objections are applicable to racing on foot, for man is not a racing animal.

Indced, it is clear that whatever disturbs the balance of the circulation, whatever unduly depresses, whatever unduly increases the motion of the heart, is wrong. The half playing lungs can meet neither extreme. If a reduced pulmonic current of blood is made, the chemical changes of respiration are the more imperfectly performed; if the heart, over active, propels an over current, the lung circulation is embarrassed, and congestion succeeds.

To sum up, the amusements of the consumptive should combine with the amusement they afford a moderate and equal degree of muscular exercise, and with the muscular exercise a degree of amusement exhilarating to the mind, but free from over excitement and undue mental toil.

CHAPTER V.

HYGIENIC CODE CONTINUED. RULES ON CLEANLINESS, ABSTINENCE FROM SENSUAL INDULGENCE, MARRIAGE, AND DIET, IN RELATION TO CONSUMPTION.

RULE IX.

Cleanliness of body is a special point in the treatment of consumption.

BUT little need be said to enforce this rule. In health there is always a mutual understanding and a kind of partnership between the skin and lungs. In consumption moderate action of the skin is a relief to the lungs, and as such ought to be encouraged. This is best attained by keeping the skin clean by daily ablution. Let the consumptive boldly take his bath as each morning comes; not a shower bath, not a cold bath, under any impression that water cast on the body in a certain fashion, or at a certain temperature, will give strength, but a tepid cleansing bath, with the temperature from five to ten degrees above that of the body. There is no occasion to stay in the bath a moment longer than to obtain a free ablution; then the patient should rapidly but effectually dry himself all over with a rough towel, and dress with the flannel garment undermost. If oil inunction has been used over night, a little

liquid ammonia may be added to the bath water, and a soap will then be made on the body during the ablution.

The clothes of the patient should be kept as clean as possible, and the under clothing should, properly, be changed every second or third day.

RULE X.

Abstinence from all habits of gross sensual indulgence is an essential part, both in the prevention and the cure of consumption.

I need not particularise the vicious sensual indulgences to which many of human kind habituate themselves; for, as suggestive descriptions are better left unwritten for those who are ignorant of sensual indulgences, so for them who require to be forewarned no such descriptions are demanded; the latter know too much already. In a word, I should say that the grosser the sensuality indulged in, the greater is the physical evil resulting from it. Let the consumptive at least bethink themselves what vices affect and prostrate most, and then with strong mind and will give them up altogether.

To those who have charge of the young, no duty is so imperative as that of carefully watching over their physical interests. Let these make it their first care to prevent the tendency to sensual debasement. In large schools, a little attention and firmness on the part of teachers and governors, with the assistance of medical supervision, would obviate a host of physical and life-long mischiefs.

A great deal might be said on this rule, which would perhaps after all do less good than the plan of leaving the rule itself simply on the mind. Instinct is better than reason; and a word to the wise is sufficient for them.

RULE XI.

The marriage of consumptive females for the sake of arresting the course of the disease by pregnancy is morally wrong, and physically mischievous.

In all ranks of life, when young females are the victims of consumption, marriage is sometimes looked to as a means for arresting the disease. There is a general feeling that if a consumptive woman become pregnant, the symptoms of the disease will be at least temporarily suspended. I do not dispute this position, for I have, I believe, witnessed the fact many times of a pregnancy checking the progress of consumption. There are physiological reasons why it should do so. As the blood of the mother goes to the support of the child which she bears, it finds, in the placental structure, and in the lungs of the fœtus, favouring structures for the deposition of tubercular matter. Hence, there is a diversion of the disease, in some measure, from the maternal organs.

But it is because the mother is thus saved at the expense of her offspring that the rule given above should be the more urgently insisted on. These innocents, thus made the scape-goats of their parents' infirmities, come into the world only half mortal; they come into the world to pass through all the miseries of a consumptive life, and, if they survive long enough, to add further misery, in many cases, by propagating other specimens of the half mortal series. This is, and must be considered an infringement of a moral law.

But it is physically wrong also; for what if, through a few months, a life be prolonged? What is the result when the period of pregnancy is past? This, and, without paradox, nothing less; that the end is the quicker for the delay. A

few weeks, nay, a few days, and the little half mortal, scapegoat *par excellence*, is left to struggle as it can, onwards, upwards, on the treadmill of its existence, without the maternal care, or the love that breathes dearest on its own.

Meantime, while yet a temporary respite is sought for, the expectant mother is prevented, in great part, from the performance of that active exercise out of doors which, we have seen, is so essential in the hygienic treatment of consumption. She thus forfeits what may be a permanent advantage, for one which is temporary, and which goes to perpetuate her own vital deficiencies in her own kith and kin.

There are, again, other cases in which marriage on the part of a consumptive person is considered, and in which the sufferer is a man. Here the questions asked refer to the value of the individual life, the contagiousness of the disease, and the possibility of hereditary transmission.

The question of the value of life in these cases, can of course be calculated by the medical practitioner only, who will estimate the amount of disease present, and the character and habits of the patient. As to the contagiousness of consumption, in which some authorities believe, I can only say, without denying the possibility of such a thing, that I can call to mind no case where such origin could be traced. Touching this point, Dr. Leared, in an admirable paper on Phthisis, including an analysis of one hundred and thirty-six cases, records that in only three males and four females, out of all these cases, could anything like an approach to contagion be suspected; and that, in four of these cases, in which contagion might be most forcibly maintained, the evidence of hereditary transmission appears. Dr. Leared adds, that "when in addition it is considered that persons living

under the same roof are rendered liable to the same diseases from the same hygienic causes, the operation of contagion in the phthisis of this country must be regarded as altogether unimportant, if, indeed, it exists at all."

On the subject of the hereditary transmission of the disease there is no doubt, the evidence being overwhelming in proof of this occurrence. I am here again indebted to my friend Mr. Cox, for an interesting account of the transmission of phthisis. In the one hundred cases observed by Mr. Cox, and already referred to, he took the trouble to ascertain the question of hereditary taint in each case. The following is the analysis of the results to which he was led.

Number of patients whose <i>fathers</i> were victims of phthisis ..	22	} 60
" " <i>mothers</i> " "	38	
" <i>pat. and mat. relatives alone</i> "	18	
" <i>brothers and sisters alone</i> " "	3	
" <i>grandparents alone</i> " "	8	
Unascertained and <i>doubtful</i> cases, wherein hereditary predisposition might be presumed to exist.....	11	
Total		100

Dr. Leared also gives the following table and observations.

HEREDITARY TRANSMISSION.

Table to show the number of Phthisical Sons and Daughters in reference to Phthisical Parents or Grandparents of both Sexes.

	Sons.	Per cent. in 66.	Daughters.	Per cent. in 70.
Father	5	7.57	8	11.43
Mother	6	9.09	12	17.14
Father and mother . .	—	—	1	1.43
Paternal grandfather .	1	1.51	—	—
Paternal grandmother .	—	—	2	2.85
Maternal grandfather .	—	—	—	—
Maternal grandmother .	—	—	1	1.43
	12	—	24	—

“The transmission of phthisis from father to daughter, by nearly one-third more frequently than by father to son, as above, is not in accordance with the Brompton Hospital report, which gives a per centage of 43·5 and 59·4 respectively; while the transmission from mother to daughter in the proportion of nearly two to one, is greater than that given in the same report, which is 56·5 to 40·6 respectively. The proportion of sons born of phthisical parents compared with daughters in the above table, eleven to twenty, or nearly two to one, is, however, closely in accordance with that given in the Brompton Hospital report, deduced from 246 cases, namely, 36·3 per cent. for females, and 18·2 per cent. for males. The investigation of the transmission of phthisis from the grandparents of patients is necessarily more uncertain; but the above is the result of careful inquiries. It is to be observed, that cases in which the parents were not affected with the disease are alone referred to. So far they tend to show that the transmission of phthisis by the maternal grandparents is more frequent in the case of granddaughters, and especially of grandmothers to granddaughters.”*

Whether the *fœtus in utero* can transmit tubercular disease to the mother, is a novel question on which I cannot dwell, as it is as yet *sub judice*. I would add, in passing, that tubercular disease is very rare in the fœtus. When writing the Fothergillian prize essay on *Diseases of the Fœtus*, I looked into this subject with some diligence. I dissected many children, that were either still-born or died soon after

* For further statistical information, I must refer the reader to Dr. Leared's valuable communication, which will be found in the *Medical Times and Gazette* for October 11, 1856.

birth, but never discovered tuberculous deposit. I have since dissected many more, and three of these have been from consumptive parents, but with the same negative result. Cruveilhier, however, found one case of tubercle in the thymus gland, and another in the lungs. Billard found tubercle in the lungs in a fœtus; and Husson, in the article Œuf (*Dict. de Méd.*, tom. xv, p. 402), gives two similar cases. In the first of these the child was born at the seventh month. in the other at the full period; in both the mothers were free from consumption.

Reviewing what has been thus written, I would add as a supplement to the rule now under comment, that, whenever distinct evidences of phthisis have set in, in an individual of either sex, the marriage of such person, so long as the disease is present, is wrong, if not inexcusable; while the marriage of two persons, both the victims of the disease, is opposed to reason and even humanity. I call to mind at this moment a melancholy example, in which a young man and woman, both of consumptive taint, married and had four miserable children. It is barely ten years since this marriage took place; and now every one of this group is dead, and all from the one disease. The eldest girl lived longest, but only to be the most wretched; she died at seven years. The mother died shortly after the birth of the fourth child; the father a few months ago. The question is to the point; Why were these poor half-mortal babes brought into the world, to add to the world's anxieties and sorrows, without having for themselves a gleam of the happiness of the world shed over their heavy but brief careers? Supreme Nature, all wise, all kind, tolerates much from those who break her laws; but sometimes, with her laws outraged beyond suffer-

ance, she inflicts the capital penalty as an arrest to further evil. What lesson is embodied in this self-evident fact, let those discover who dare to look at the natural truth.

RULE XII.

The diet of consumptive patients should be ample, and should contain a larger proportion of the respiratory elements of food than is required in health.

The appetite of consumptive patients is very capricious, and daily grows more so if it is not sharpened up by exercise. When the food taken is not applied to the purposes of nutrition, it is better left untasted; for otherwise it lies undigested in the alimentary canal, and sets up a serious train of dyspeptic symptoms, nausea, and diarrhœa. Kind friends often, with the most provoking and mistaken good nature, thrust upon the consumptive relays of the most improper food, because the necessity for nourishment is so obvious. But the fact is that, when the lungs are acting indifferently, digestion cannot go on actively; since, as Arbuthnot well observed, respiration is "the second digestion". Hence the quantity of food taken by the consumptive person should be small at each meal; but the meals may, if the sensations of the patient require it, be more frequent than in health. Animal food is an absolute necessity, and of all animal foods, mutton is the best. Fatty and oily foods, which constitute the respiratory class, should predominate, and fresh butter, with bread, may be taken almost *ad libitum*, so long as it agrees with the stomach. Cream, too, is very excellent, and the northern luxury of curds and cream is well suited to these cases. Milk, whenever it suits, is advisable as a constant beverage, and good cow's milk, new, answers every purpose; at all events there

are, as far as I can gather from cases in which I have seen them tried, no such specific virtues in asses' milk and goats' milk as some have supposed. Tea is nutritious, and may be taken in moderation with perfect safety. Fresh vegetable diets should not be omitted; and fruits, especially roasted apples, are always admissible, except in instances where they excite irregular action of the bowels. The Iceland moss has had a great reputation, as have jellies of different kinds, but these often are slow in digestion, and they have no specific value. Alcoholic drinks in moderate quantities should never be denied the consumptive. Good port wine, unadulterated ales, and even brandy and water, are useful. Rum and milk was once a famous remedy, and I believe I have seen it do good, but not uncommonly it gives rise to acidity and flatulency.

In the selection of these various articles of food, the safe plan is to allow the instincts of the patients to guide the practice. These instincts rarely misdirect; but if they are disobeyed, the results are too often disastrous. The one independent rule which should be impressed on the patient by his adviser is that given above, namely, to take in as much of the respiratory foods, in the shape of fatty and alcoholic substances, as he feels consistent with his desires and with temperance; for as he lives in some measure in a perpetual winter, he, like the Esquimaux, calls the more freely for the feeders of animal combustion. As regards times of eating, let the instinctive feelings again have their way; when hunger calls, let it be obeyed at whatever season; and when the stomach says "enough", let that order be attended to with equal punctuality.

There are two habits in which some consumptive men

indulge which deserve to be mentioned, though not altogether in place under the present head ; I mean snuff-taking and tobacco-smoking. Both these habits interrupt the respiration, supply a depressing poison to the blood, and injure, as a result of all, the digestive system. I speak with care as regards smoking by healthy men ; but to the consumptive the practice is absolutely opposed to recovery, and must therefore be strictly forbidden.

CHAPTER VI.

BRIEF NOTES ON THE MEDICINAL TREATMENT OF PULMONARY CONSUMPTION.

Rational views on treatment. Popular follies regarding specific medicines. Uses of medicines. Cod-liver oil. Quinine and iron. Opium. Gallic acid. Oil inunction. Treatment in hæmoptysis. Elements of treatment.

It has been shown in the first chapter, that, in order to obtain perfect success in the practice of medicine, the hygienic and the curative systems of treatment must be conjoined. As yet I have dwelt on the subject of hygienic treatment alone in reference to consumption; and this, not from any disparagement of the medicinal plan, but from a belief that medicines are of little service unless combined with a true hygiene.

To speak more to the point, it seems to me that even the administration of medicines themselves must be performed by hygienic, or, in other words, physiological rules, if such administration is to be of real service. The idea of having a specific remedy for every specific disease is now pretty well exploded amongst the highly educated classes of medical practitioners, who see indeed that the whole course of medical inquiry, from Hippocrates downwards, has but discovered three, or at the most four, *bonâ fide* specifics, and

these by accident; who see, further, that diseases are most easily cured by removing their efficient causes; who maintain that the true study of diseased action lies in the true study of life and its phenomena; who appreciate the fact that diseases of all kinds are nothing more than modified physiological conditions; and who in practice feel, that as, with one or two exceptions, medicines are only specially useful in removing or relieving the special symptoms of a disease, so any disease itself, as a whole, is removable by a removal of the general influences which gave it birth, and by no narrower process or practice.

These, I believe, are the views now received in the medical profession; but the public have not yet fallen into them, most unfortunately for their own interests and their lives. The people still want the specific. The specific may be a pill, a plaister, a dose of foxglove tea, a homœopathic sham in the shape of an infinitesimal dose of a china teacup soaked in moonshine; a twopenny whistle through which to blow for three hours per day; a few drops of cold water on the head, or a wet sheet in which to be encased; a certain gymnastic exercise, right thumb twiddled over the left for ten minutes every night on going to bed; or a breath of cool air over the face, fanned by the hand of a Mesmerist, himself inwardly convulsed with laughter in thinking how easy the poor fool before him is played upon. These, I say, are the sort of specifics which the people run after, and on the invention or practice of which unscrupulous persons base a dishonest reputation, and outstrip the conscientious physician. It is from popular imbecilities of this nature that the disease consumption holds a place so prominent in the mortality scale. Like the clown running towards the foot of the rainbow to find the bag of

gold there deposited, while he leaves behind his wallet of bread and cruise of milk, the consumptive man runs after a specific for his disorder, while he thinks not of the essentials of his very existence, of the air he breathes, the food he eats, or those laws by which health is maintained, and by which the body in its transitions is so justly balanced between the forces of restitution and decay, that life, which in the abstract is death with regeneration, shall not lapse into death absolute. For my own part, I believe in no specific for consumption, although I believe fully in the invaluable qualities of some few medicines, when these are simply applied, are made to assume the characters of foods as far as is possible, or are directed, on physiological grounds, to the abatement of certain symptoms. In the value of cod-liver oil I have great faith: it is, in point of fact, a food, and can scientifically be considered in no other sense. It was observed in a former chapter, that the consumptive man, with his lungs half lost, was living virtually in a perpetual winter, like an Esquimaux. Under these conditions, he requires more of the respirable or combustible foods, and these are best supplied in the fish oils. But some care is required in the administration of the oil. In the first place, whenever a patient begins to take it, he should have it in small doses often repeated; one teaspoonful four or five times a day is amply sufficient. Given in these proportions, it is easily assimilated, produces no nausea, and is less liable to give rise to diarrhœa. According to the manner in which the oil is tolerated, the dose may be increased even up to half an ounce or a full ounce at a time: beyond the ounce, it is not, I think, necessary ever to go.

Cod-liver oil should never be commenced, or, if it has

been commenced, should never be continued, while dyspeptic symptoms are present; such symptoms, for instance, as loaded creamy tongue, nausea, pain and fulness after food, eructations, yellowness of skin or of the cornea, or relaxed state of the bowels. In such circumstances, attention must first be paid to the digestive functions; and an alterative, once or twice repeated, with care regarding diet, will prove of great service.

The oil, so long as it is being taken, should be swallowed shortly before a meal; it is then assimilated with the other food.

The nauseous character of cod-liver oil is not removed, but rather increased, by admixture with anything else, as syrup or emulsion. The best mode of taking it, by those who cannot accustom themselves to swallow it in the pure state, is to let the dose float on a little orange wine; and then, having poured a small quantity of wine over it, to swallow the whole at once. Generally, however, such resources are unnecessary, the patient becoming accustomed to the taste of the remedy.

Occasionally, even when there are no marked dyspeptic symptoms previously, cod-liver oil produces nausea or diarrhoea. Under such circumstances, a half minim of creasote with each dose of oil exerts a beneficial influence. Should it fail, the oil may have to be suspended altogether.

In cases where cod-liver oil cannot be borne, other substances of an analogous character may be recommended. I have sometimes ordered bacon fat in such instances with advantage. In a few cases, cream was administered in doses of a wineglassful three times a day, and, I believe, with benefit. During the administration of the oil, should catarrh

or continued feverish symptoms intervene, it is better to suspend it. The necessity for such suspension is indeed soon felt by the patient himself, in nausea or even vomiting after the dose is taken.

Again, patients sometimes complain of eructations after swallowing the oil, which are exceedingly disagreeable, and give rise to a wish to stop the medicine. The best means I know of for preventing this occurrence is to have administered, after the oil, one or two teaspoonfuls of brandy, to which have been added a few grains of the common carbonate of soda.

Quinine and iron are also invaluable remedies in the treatment of consumption. Their efficacy cannot be overestimated. A little care is, however, required in selecting them as tonic remedies. In cases where the hectic attacks are regular, where the skin is hot, the pulse quick and sharp, the tongue loaded, the night sweats profuse, the expectoration profuse, and the breath distinctly ammoniacal, in cases of this kind, the effect of a grain of quinine taken three times a day, with ten minims of nitric acid, and the same quantity of paregoric, in an ounce of water, is sometimes almost magical, and always useful. In other cases, where there is marked anæmia, where the tendency to feverish excitement is feebly presented, where the pulse is quick without being sharp, and where the sensation of prostration is always felt, the iron comes into play with great effect. The preparation of iron which I find most useful is the tincture of the muriate, in ten minim doses, three times a day, along with food. To this, if the patient is troubled much with cough or expectoration, ten minims of paregoric are added to each dose. The quinine and iron, used judi-

ciously, and in their proper places, are, as it appears to me, applicable in every stage of the disease, from the first to the last. They act as foods; they are often assimilated when even ordinary foods are not; and they assist such foods in being themselves assimilated. Believing that phthisis, in its earliest stages of development, is an indication of a depressed, and, to use a somewhat mystical but pretty well understood term, a devitalised condition of the body, I give these supporting remedies from the first, and, with the exception of brief intervals in which some complication may arise, to the last. The result of this medicinal line of treatment, coupled with the hygienic, is satisfactory to the utmost; and if I could but induce all members of the medical profession to carry out the same plan boldly and sedulously, I am sure they would very soon add new proofs of the truths here inculcated.

To alleviate the sufferings of the consumptive, to quiet cough, and give sleep, opium is the one and all-sufficient remedy. It seems to me a matter of little moment how this old and grand medicine is given, so that it be given with effect and discretion. It may be combined with the iron or quinine; it may be made into a syrup, for occasional use when paroxysms of cough are severe; it may go with the chloric or sulphuric ethers, if the breathing is difficult, and the cough spasmodic. The judgment of the medical practitioner, with this as with all remedies, must of course regulate the administration.

For the arrest of the night sweats, taking it all in all, gallic acid, as an internal remedy, holds, as I think, the first place, if given in full doses, say from five to ten grains at bedtime, combined or not, as may be necessary, with an opiate.

For the same intention some external applications are useful for a time, such as sponging with vinegar ; but the good effect wears off. Latterly, taking a hint from Hippocrates, I have ordered inunction with oil over the whole body prior to sleep ; and the result in three cases, the only ones in which this process has yet been ordered, has been excellent.

A word about hæmoptysis as a complication of phthisis. Whenever this symptom supervenes, I make it a point simply to withdraw the cod-liver oil ; to withdraw stimulants ; to withdraw iron, if it is being given ; to enjoin a little more bodily rest ; to ventilate the apartment of the sufferer more sedulously than ever ; and to throw in the quinine and the mineral and gallie acids more freely than before. The more a man is physically lowered, the more fluid the condition of his blood becomes, and the more freely will that man bleed if his circulating system is ruptured. Animals of a brisk respiration and circulation, with richly fibrinised blood, cannot be bled to death by the laying open even of a large artery, the vessel is annealed by the blood clot so speedily. I have divided the carotid of a dog cleanly across, and have seen the current stop after two or three jets, without any interference whatever.*

* In experiments with styptics, some experimenters have made serious mistakes regarding the effects of styptic solutions ; for this reason, that they have operated on animals whose divided vessels would cease to pour out blood without the application of the styptic at all. Hence, because the hæmorrhage stopped when the styptic was applied, the conclusion has been rushed at that the styptic arrested the blood-stream. In reasoning on the action of medicines, errors of a similar nature to this are very common. Results arising from external causes are attributed to particular acts done by the prescriber. In the sick room, the fire and the window are the two first externals to which the physician should look. If these are left to the untaught management of an ignorant nurse, the most scientific medical treatment is at once jeopardised, and in many cases rendered absolutely nil.

In treating hæmorrhage in man, where the vessel cannot be tied, this fact cannot be too forcibly insisted on. To draw blood from a man already bleeding from the lungs, to put him on water diet, to purge him with salts, is opposed equally to physiology, pathology, and practice. If a man were bleeding from the femoral artery, would any one then think of bleeding him from the arm? Is venesection the remedy for a woman dying of uterine hæmorrhage? Surely not; nor is it the remedy in hæmoptysis.

Any way, in a practical point of view, I know, after a fair trial of the two plans of treatment, the derivative or depressing plan, and the plan of administering pure air in constant stream, with acids and quinine as medicines, that the latter is more effective in cutting short the flux, while it has the immense advantage also of leaving the patient no further depressed than the disease itself is capable of rendering him.

In these brief notes, I have given faithfully the whole medicinal system of treatment which has been carried on in the patients under my care at the Royal Infirmary for Diseases of the Chest, during the last eighteen months. Sometimes twenty patients at one time have been thus treated. Counter-irritation of all kinds has been entirely thrown aside; the pharmacopœia for phthisis has been reduced to some half dozen remedies. The result is that, from a state of despair as to the success of treatment, I have learned clearly, and from material facts, that, with a simplified medical regime, and a strict attention to the laws of life, without which all physic is vain, consumption is not only a preventible, but, even in its second stage, a curable disease.

CHAPTER VII.

ON AIR AND VENTILATION.

Uses of air to man. Demands for free ventilation. First plans of ventilation. Modern plans. The true natural system. Amount of air required for respiration.

THE subjects of Air and Ventilation have so direct a bearing on the matters discussed in the preceding chapters, that an apology for introducing the present chapter is scarcely necessary. It has been written in a plain and simple style; it embodies a few facts which may be useful at first sight; and it is intended to serve as an index to sources of further information for those who are interested in the questions to which it directs attention.

Dr. Arnott, in his excellent work on *The Smokeless Fireplace and Ventilation*,* has made some admirable observations on the comparatively modern application of the principle of ventilation in public and private buildings. He shews that, a century or two ago, men were not even aware that

* On the Smokeless Fireplace, Chimney Valves, and Other Means for Obtaining Healthful Warmth and Ventilation. By NEIL ARNOTT, M.D., F.R.S., F.G.S.

Memorandum on Asiatic Cholera and Other Epidemics as Influenced by Atmospheric Impurity. By NEIL ARNOTT, M.D., F.R.S. Report to Board of Health. 1854.

the atmosphere was a “thing;” and that they have only become acquainted with this fact, as they have been taught that gases can be measured like water, and have learned some of the properties of the element oxygen, which the immortal Priestly discovered in the latter part of last century. Hence one of the essentials of life, a sufficiency of pure air, has been considered of little account.

It is to be regretted that, even now, although oxygen has been discovered, and gases have been measured like water, and Dr. Arnott has written a philosophy in simple style, no due importance is paid to the matter in hand by the public at large. Nay, it is further subject of regret that the medical profession as a body, advanced as it is, is not yet alive to the full extent, end, and meaning of efficient ventilation in its applications to the promotion of health and the treatment of disease. Old traditions, fancies, and fables linger yet around the Esculapian priest; still the alarm about chills and draughts perplexes; and still the danger to the patient of leaving his bed or his room in days of returning health, “lest a relapse be the consequence”, is presented to the mind as a scarecrow, which need only be walked up to in a cool humour to be mercilessly and safely demolished.

The uses of air to man and his lower earthmates are not easily comprehended at first sight; they are so varied, and, to the uninitiated, so subtle. The effect of the ordinary atmospheric pressure on the body is a first essential to healthy life. It is by this pressure, exerted uniformly over every point of the body, that the corporeal framework is the more firmly knit together. We are, as it were, casts in moulds of air. Removed to a mountain height, where the atmosphere is lighter and the pressure diminished, the body suffers, to

borrow a description from Dr. Speer,* “with symptoms (varying in degree and number in different individuals) of vertigo, headache, dyspnœa, constriction of the chest, palpitation, syncopal tendency, oozing of blood from the mucous surfaces, increased rapidity of the pulse, nausea and vomiting, thirst, febrile tongue, muscular pain, sense of extreme debility in the lower limbs, and general prostration of strength”—results arising, according to the same author, from a three-fold source: congestions of the deeper portions of the circulatory apparatus, increased “venosity”, in plainer words, impurity of the blood, and “a loss of equilibrium between the pressure of the external air and that of the gases existing within the intestines.”

The symptoms thus induced bear, in the opinion of Dr. Speer, a close analogy to those of an ephemeral fever: a remark of great importance in a physiological point of view.

Similar symptoms may be produced in animals, by the removal of a portion of the atmosphere from a vessel in which they are confined, and in other ways. If, for instance, to the ordinary pressure of the atmosphere on the body some general mechanical pressure be added, such as the application of a moderately tight bandage to a limb, the artificial compression is tolerably well borne when evenly applied. But if such bandage be now rapidly removed, the relief is painful, the blood rushes into the recently contracted vessels, the skin becomes red, and a painful tingling sensation is, for a moment or two, experienced. If this artificial pressure be extended to the whole body, these results are more

* The Physiological Phenomena of Mountain Sickness. By STANHOPE T. SPEER, M.D.

striking. They represent, in a minor degree, the effect of removing the atmospheric pressure.

But there is another use to which the ordinary atmospheric pressure extends. Under its influence the lungs are kept charged with air. When the chest is expanded in the act of inspiration, the pressure of the atmosphere causes the lungs to fill with air, and to follow up the expansion of the walls of the chest. During the act of expiration, on the other side, the entrance of external air into the lungs is, in a great measure, prevented for the moment, and the external air itself becomes the recipient of the expired gases.

Thus, the mechanical effects of atmospheric pressure on the body are most important, and the effects of extreme variations of pressure are well mapped out by certain striking symptoms. How far the effects of those lesser variations of pressure which occur at ordinary levels, and which are indicated by ordinary barometrical changes—how far these exert a physical influence on the body, is as yet a question open to an extended series of observations and experiments.

A second important use of the atmospheric air relates to its influence on the animal temperature in a physical point of view. As the heat made in the body passes off from it at every point by radiation, it commingles, to use a common term, with the atmospheric medium in which the body is en-cased. Thus, if the external atmosphere be cooled far below the level of the body, then the radiation of the animal heat is so vigorous, that an arrest of vitality, more or less marked, according to the degree of cold, becomes necessarily manifest. A great variety of physiological changes in this case supervenes. Nutritive acts, which are dependent for their con-

tinuance on a full development of caloric, are impeded. The great chemical changes of respiration, the absorption of oxygen, and the evolution of carbonic acid, are reduced; internal congestions follow, and the circulation fails in power; lastly, the soft structures, losing their expanding principle, shrink, the capillaries contract, merely in all probability from the loss of caloric: and the whole of what in the aggregate sense may be called the vital forces are, in a greater or lesser degree, checked in their course.

On the opposite side, when the temperature of the external air is raised towards a level or above that of the body, the due radiation of heat is checked; then the reverse of the above conditions obtains. The nutritive and destructive changes of tissues are accelerated; the muscles are relaxed; the capillaries easily dilate; and the secretions are profuse, from the skin, the lungs, and the kidneys. But this exalted condition of body can no more be tolerated than the opposite, for any length of time. The chemical forces of life are here too actively engaged; they must be brought back to steadier play, or they will stop altogether.

The happy medium for equalising the temperature of the body is the atmosphere. We instinctively perform something for ourselves in this respect, in the use of clothes, of which we put on more or less as sensation tells us. But it is our air garment, or mould, which does most. If this naturally retains an equality, its 60° to 70° Fahr., we are comfortable; if it, capricious, dance about from 32° or less up to 90° or more, we must put it under some certain rules,—must confine it in sections, in rooms where we live, and artificially warm it, in the first case; must give it free vent, and lower its temperature by agitation, in the second case. Upon a due consideration

of these facts the science of warming and ventilating rooms and buildings essentially depends; as does also the manner of clothing the body, so as best to enable it to meet the vicissitudes in the temperature of the enveloping air.

But the atmosphere does yet more in the way of aiding and abetting the body to live. It removes from the body its volatile refuse, and distributes this refuse into space.

From the lungs at each expiration, for example, about twenty cubic inches of impure air are yielded, or about as much, says Dr. Arnott, symbolically, as would make up the bulk of a full sized orange. Having left the chest and got out of doors, it rises just as a soap-bubble would, or a balloon; for being itself at the moment of expulsion heated to nearly the temperature of the body, viz., 98 degrees Fahr., it is of lighter density than the atmosphere, floats up in it, becomes diffused, and is at last, by wide spreading, brought to nought.

As, then, the heated vapour from the breath escapes, it rises, and a purer proportion is inspired. What becomes of the invisible "orange" thus thrown off, and why it does not come back, in part at least, direct on the head of the individual, is due to the principle of "diffusion", on which a word must be said.

When two liquids of different densities are put together—say oil and water—they do not remain long in the happiness of a united pair. The oil, taking advantage of the density of the water, floats to the top, and makes for itself a very comfortable water-bed, where it reclines uncontaminated, as all may see. But if two gases of different densities, such as carbonic acid, a heavy gas, and hydrogen, a light gas, be mixed together, they continue mixed, as free gases be it

observed, but commingled freely ; nay, if a jar of light gas be inverted over a jar of heavy gas, so that the two gases are brought thus simply into communication, the two at once agree to unite in the most friendly fashion. The heavy gas politely rises, the light gas gallantly descends, and in the end there is a complete admixture—brandy and water are not more accommodating to each other.

The discovery of this tendency on the part of one gas to diffuse into another gas was made by Dalton, sandal-maker to the immortals, and himself immortal cobbler, who pushed his argument by demonstration so far, as to lay down a kind of axiom to the effect that gases of different kinds and densities afford no resistance to each other, but run into each other as they would into a vacuum ; and although the labours of Professor Graham have shewn that the diffusion process takes place in different gases with different degrees of rapidity, and that gases are not absolutely vacua to each other, yet the final result is the same as though they were ; since it has been proved that gases do, in fact, rush into a vacuum with velocities corresponding to the numbers which have been found to express their diffusion volumes, *i. e.*, with velocities inversely proportional to the square root of the densities of the gases.

Of the cause of this mutual diffusion of gases we are not so clear. There is yet another great law to be discovered in this direction. But it is sufficient for our present purpose to know the fact, that no gaseous matter can be set free, whether from the animal body or from aught else, without being at once freely diffused in the great ocean of the atmosphere, as though practically it were being spread through a great vacuum.

It is impossible to overestimate the magnificence of meaning implied in this grand natural law. This great aerial sea, forty-five miles deep each way from any point of the earth's surface, and into which we insignificants can but raise ourselves with the help of bricks and mortar some few poor hundred feet; nay, into which our madcaps who try to pierce heaven on a gas-bag cannot penetrate more than a mile or so; this great aerial sea, how competent for the end had in view, how capacious a chamber for the distribution of coal smoke, human breath, volcano vapours, and poisons innumerable.

And, lastly, the winds must not be forgotten. Think of winds—great agitations of great atmosphere in the great chamber, always mixing up everything on the large scale, as if some enormous Maelström were perpetually at work in the universe; but all in order, all according to the first law—Order. The wind movements, however, and all the effects of admixture springing out of them, must be carefully removed from the diffusion process. That is to say, there must be no relationship of cause and effect introduced between them. None such exists. The diffusion process is a fact *per se*, it takes place in air in a state of rest, the same as when such air is in a state of motion.

There is a fourth, and yet more important use of all, which the air around us plays in regard to the men and animals who live at the bottom of it, as at the bottom of an immense air lake or sea. The scientific world now-a-days recognises air to be a food, as much a food in its way as beef and potatoes in their way. The old saying about the chamcleon,

“Stretched at its ease the beast I viewed,
And saw it eat the air for food,”

is thus no poet jingler's fancy, but a fact. Air is food;

the first food of man and of everything that lives. The chief sustaining element of the air inspired in breathing is the oxygen, which forms a fifth of the whole of the atmospheric sea. The nitrogen, which forms the remainder of the sea, and is usually said to be the mere diluting medium of oxygen, is, however, not altogether inert, for a small portion of it taken in by each inspiration is made use of, or at all events does not return in expiration. The quantity of air received into the lungs of the healthy man at each ordinary inspiration is about twenty cubic inches. This is but a small portion of that which he is capable of receiving, for his chest has a capacity for at least two hundred inches, when well filled, so that he has a reserve portion always in store,—a bank of air. The process of diffusion of gases is here also brought into play ; for before the expired air leaves the lungs, the products of waste, which are to be cast off from the blood, are diffused into the air with which the lungs are steadily filled. This provision is admirable, in that it keeps the interchange of pure air for impure air in the lungs going on in one unbroken current, places the command of the respiratory act in a partial degree under the will of the individual, and prevents mishaps which might arise, such as the temporary suspension of respiration, from becoming immediately fatal.

The lungs in health are thus always charged with air ; and this air, carried to the extreme ramifications of the air-tubes, and thence into the air-cells, of which there are in the human lungs about six hundred millions, is brought into indirect contact with the blood, which is circulating round the lungs from the right to the left side of the heart. I say indirect contact, because the air-cells are lined with

membrane on their part, while the blood which plays over them is itself also enclosed in plexuses of vessels, almost infinitely minute, so that there is an intervening membranous screen between the air and the blood. Here, in this fine but expansive network of air-cells and blood-tubes, do the interchanges of air and blood take place through the membranes. Here the blood returning from all the body, through the right side of the heart, gives off its gaseous refuse ; and here the same blood is reinvigorated by the absorption of oxygen and the small quantity of nitrogen already spoken of, with possibly some amount of water. The oxygen, if not the nitrogen, is *food*; and thus the process of respiration is another process of digestion. Going round with the blood to all parts of the body, this oxygen supports all the acts of nutrition ; helps to build up the new, assists to remove the old ; the phenomena of life are, in fact, all described in the term oxygenation.

Springing out of these considerations, there is yet one other important fact to be considered in relation to air and man : we mean the generation of animal heat. We have seen that the atmosphere is the grand external medium for regulating the temperature of animal bodies ; it is also the grand medium for supporting the temperature of these bodies. The process of animal heat-making is again a process of oxygenation, not specially carried on in the lungs, it is to be understood, (not carried on in the lungs at all, M. Claude Bernard says) but in every part of the body where oxygen enters into combination with tissue so as to give rise to a new combination.

To epitomise, we see in the air a variety of uses. It affords mechanical support ; it is a heat modifying medium ;

it swallows all gases exposed to it; it supplies a food to man, out of which he is in part built up; it feeds him with the active principle by which the warmth of his body is sustained.

Upon such simple processes as these, coupled with other processes for the supply of food through digestion, the whole system of organised life depends; and hence some writers have drawn an analogy between animal man and the steam engine, an analogy remarkable in its leading points.

“Allow us”, says Dumas, in speaking of the vegetable world, as supplying the necessaries of existence, “allow us to borrow from modern science an image sufficiently grand for comparison with these grand phenomena, and to compare the actual vegetable world, the true magazine from which the animal world derives its elements, with that other magazine of carbon, formed by the ancient deposits of coal, and which, burned by the genius of Papin and Watt, has produced carbonic acid, water, heat, motion, one would almost say life and intelligence.”*

Dr. Arnott also gives the following table of comparison:—

“THE STEAM ENGINE IN ACTION	“THE ANIMAL BODY IN LIFE
Takes:	Takes:
1. FUEL, viz.—Coal and wood, both being old or dry vegetable matter, and both combustible.	1. FOOD, viz.—Recent or fresh vegetable matter and flesh, both being of kindred composition, and both combustible.
2. WATER	2. DRINK (essentially water).
3. AIR	3. BREATH (common air).

* Permettez donc, qu'empruntant aux sciences modernes, une image assez grande pour supporter la comparaison avec ces grands phénomènes, nous assimilions la végétation actuelle, véritable magasin où s'alimente la vie animale, à cet autre magasin de charbon que constituent les anciens dépôts de houille, et qui brûlé par le génie de Papin et de Watt, vient produire aussi de l'acide carbonique, de l'eau, de la chaleur, du mouvement, on dirait presque de la vie et de l'intelligence.

And produces :

4. STEADY BOILING HEAT of 212 degrees by quick combustion.
5. SMOKE from the chimney, or air loaded with carbonic acid and vapour.
6. ASHES, part of the fuel which does not burn.
7. MOTIVE FORCE, of simple alternate push and pull in the pistou, which, acting through levers, joints, bands, etc., does work of endless variety.
8. A DEFICIENCY OF FUEL, WATER, OR AIR, first disturbs, and then stops the motion.
9. LOCAL DAMAGE from violence in a machine is repaired by the maker."

And produces :

4. STEADY ANIMAL HEAT of 98 degrees by slow combustion.
5. FOUL BREATH from the windpipe or air loaded with carbonic acid and vapour.
6. ANIMAL REFUSE, part of the food which does not burn.
7. MOTIVE FORCE, of simple alternate contraction and relaxation in the muscles, which, acting through the levers, joints, tendons, etc., of the limbs, does work of endless variety.
8. A DEFICIENCY OF FOOD, DRINK, OR BREATH, first disturbs, and then stops the motion and the life.
9. LOCAL HURT OR DISEASE in a living body is repaired or cured by the action of internal vital powers."

I have recorded these general observations on the influence of air on animal bodies, because, in the absence of knowledge bearing on such subjects, it is impossible either to understand the objects of ventilation, or the means to carry out any efficient plan of ventilation. I have shewn that the air is of great service by the pressure it exerts ; that it acts as a warmth modifier ; that it disposes of gases and vapours ; that it supplies nourishment to the body ; and that it sustains the animal heat. These things considered, the importance of a free ventilation, of a steady current of pure air around the animal body becomes at once manifest to every mind. As in the steam engine so in the man, no movement, no action can be well done without the free vent of air.

Nomadic tribes, living mainly out of doors, or covering themselves in from the rain and wind in canvass tents, take and require but little care in regard to ventilation, since they interfere not with atmospheric laws. But when men begin to erect stone walls, to hedge themselves in from the atmosphere with impermeable barriers, and to pollute their confined dwellings with their own emanations, the matter is

reversed. Supreme nature is defied, and the defiants pay the forfeit always visited on such delinquency. Under these circumstances the principle of ventilation, as it is called, has slowly been evolved out of nothing, and has suggested various ways and means by which the atmosphere may be made subservient to the designs and life methods of men. Even in the early days of architecture, when real stone or wood houses were first built, the necessity for any special attention to ventilation was uncalled for. In these days, when light was admissible into the building by means only of large open casements, the air went in with light, and was as freely diffused. In the old Roman house, with its *compluvium* and numerous unbarricaded windows, the ventilation must have been perfect and simple. But when it became the fashion to let in the light alone, and thus to cut off the air from the same entrances, then the evil effects of confined air in houses became a necessity, in the absence of some new means for its free admission and after removal. This inconvenience was felt the more in places where great numbers of people were placed together in one limited spot; as on board ship, in the wards of a hospital, the compartments of a prison, or even in the closely built streets of a town. What amount of disease, what amount of death, must have ensued for many centuries from absence of pure air, and whilst men were ignorant of the actual value of air in its relation to life and health, it is impossible to say.

For many ages after the days of the old Roman literature, little of worth is met with on the vital properties of air, and the importance of a free air current. For sound instruction on these points, the world had to wait for Dr. Hales, whose physiological labours are amongst the most

remarkable records of natural science in the beginning of the last century.* Unable, in his day, to make a correct analysis of air, Hales nevertheless succeeded in showing, with remarkable correctness, the physical and even the chemical virtues of this gaseous material. He showed that air was a “thing;” he measured the 220 cubic inches of air which the chest can contain; he measured the number of cubic inches drawn in at each inspiration; he even approximated to the loss sustained in the lungs by the absorption of oxygen and nitrogen; whilst in his researches on the re-respiration of expired air, he describes unconsciously the physiological influence of carbonic acid.

With these facts before him, Hales was not slow to see the importance of free ventilation. “Thus”, he observes, “what we call a close warm air, such as has been long confined in a room, without having the vapours in it carried off by communicating with the open air, is apt to give us more or less uneasiness, in proportion to the quantities of vapours which are floating in it. For which reason the German stoves, which heat the air in a room without a free admittance of fresh air to carry off the vapours that are raised, as also the *modern* invention” (A.D. 1733) “to convey heated air into rooms through hot flues, seem not so well contrived to favour a free respiration as our common method of *fires in open chimneys*, which fires are continually carrying a large stream of heated air out of the room up the chimney, which stream must necessarily be supplied with equal quantities of fresh air through the doors and windows, and crannies of them.”

* Statical Essays, containing Hæmostaticks. By STEPHEN HALES, B.D., F.R.S. 2 vols. London: 1733.

But to follow Hales yet a step further. "Two gallons of air", he states, "breathed to and fro for two minutes and a-half become unfit for respiration. Whence no wonder", he continues, "that the air should be infected, and apt to breed distempers in close prisons, where not only the breath, but also the plentiful perspiration of many confined together stench the air, and make it apt to breed what are called gaol distempers, which inconvenience might in a great measure be prevented if gaols were so contrived as to have a free passage for the wind to blow through them, and thereby communicate fresh air, for want of which many of those unhappy persons are not only deprived of liberty in gaols, but too often of life also."

Speaking of the ventilation of ships, the same author refers to the old plan of washing the beams and decks with vinegar. This, he says, can never take the place of a thorough ventilating air; but "there may be a ferment between this acid and the then too alkaline air, which may thereby be reduced in some degree from its alkaline to a neutral more wholesome state."

Arbuthnot also gave some sound views regarding pure air. The respiratory act he designates as "the second digestion", and comments upon the value of a pure atmosphere in all disorders.*

Sir John Pringle, in his important work on the *Diseases of the Army*, published in 1768, dwells with great emphasis on the importance of a free ventilation in hospitals. His rule for preserving the purity of such places is a sound one, viz., "to admit so few patients into each ward, that anyone

* Effects of Air on Human Bodies. By J. ARBUTHNOT, M.D. London: 1733.

unacquainted with the danger of bad air might imagine there was room to take in double or triple the number. I have generally found", he adds, "those rooms most healthful where, by broken windows, and other wants of repair, the air could not be excluded."

In the event of a room being deficient of a chimney, which, when present, acts as a constant ventilator, Sir John recommends the use of Dr. Hales' ventilators, and appends a note written by Dr. Hales on the manner in which these ventilators are to be applied. "A board was to be screwed fast to the upper part of a window on the outside of each room. This board was to have a round hole in it, and also the glass opposite to it, of a size sufficient to receive a trunk of a sufficient length to reach from the window *to a small ventilator* on the ground, through which the foul air was to be drawn out of each room, the fresh air entering in at the door. The same trunk would serve for windows of different heights by being placed more or less obliquely. A very small ventilator will be sufficient for this purpose—about five feet long and twenty inches wide."

The ventilators of Dr. Hales, here noticed, were a novelty in their day. They were not exactly new to the world, for the old Romans had invented a bellows for the ventilation of mines, of which Dr. Hales' machine was merely a modification, and hardly an improvement.

However, in the Hales ventilators, a revival was instituted, of which the Royal Society had the privilege of hearing in 1741.* The atmosphere was to be made now the slave of the builder. A man with mysterious bellows under his arm

* Dr. Hales was also the author of a "Treatise on Ventilators".

offered his assistance and even patronage to His veritable Royal Highness the Prince of the Power of the Air. His Highness was tickled at first, but objected to the interference when he found the man was in earnest.

The mysterious bellows themselves, called by their author, in reference to their application to ships, "the ships' lungs", consisted innocently enough of a square box, divided transversely by a horizontal partition of wood. This partition, being supported by two hinges fixed in the centre of one of the ends of the box, admitted of being moved up and down at its other end by means of a rod, which passed through an opening in the upper side, or top of the box. At that end of the box to which the hinges of the centre partition were attached were four holes—two above, and two below the partition. These holes were armed with valves, the two upper ones opening—one inwards, the other outwards; the two lower ones opening also—one inwards, the other outwards. By this arrangement, whenever the partition within was moved up and down at its free end a change of air was established. As the partition went down, the air in the lower compartment was forced out in part through the valve opening outwards, while pure air was admitted into the upper compartment through the opening, the valve of which opened inwards. As the partition went up the action was reversed; but the result was the same. The machine was worked by the hand, and on board several men were employed to pump at intervals the impure air out of the lower parts of the vessel.

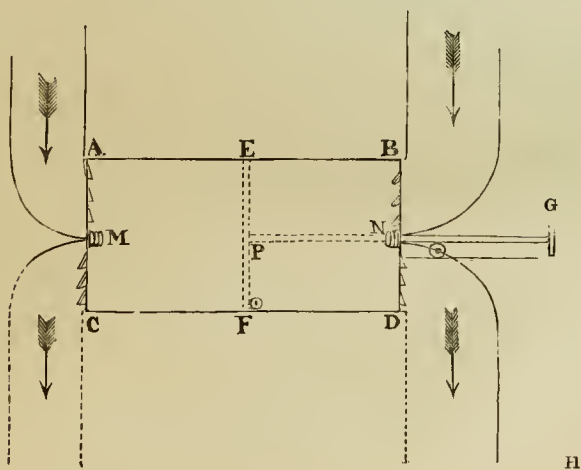
Another machine, an improvement on the Hessian bellows, was also invented about the same time by the Rev. Dr. Desaguliers.

The ventilation of Dr. Hales was applied extensively in the navy when first brought into notice: for Hales had influence at head quarters; was patronised by Prince Frederick; became afterwards the almoner of the princess dowager; and might have been a bishop if his tastes had run in that high and mighty direction.

The ventilation failed, however, for reasons which Dr. Arnott thus points out:—"The valve apertures were each only one forty-fourth part as large as the surface of the piston", and "caused expenditure of eighty-eight times the force that would have moved the air if there had been no such impediment. The labour implied in the working of Dr. Hales' machines led to their discontinuance."

Improving on this principle, Dr. Arnott has, in these days, invented a pump, which he calls the "single ventilating pump". Its action is exceedingly simple, and it has been employed effectually on board the *Anson* convict ship. It is thus described:—

"The accompanying sketch represents the single ventilating pump. Let A B C D mark a large case of wood like a packing-case,



made accurately square, resting on its side. Within the case is a moveable partition *E F*, fitting the box like the piston of a pump to within the twentieth of an inch on all sides, so that it may be pushed to and fro with little friction and impediment. This moveable partition has a stalk or piston-rod *P G*, to the outer extremity of which *G*, a hand or other power may be applied to work it. The lower edge of the piston may rest and slide on two smooth bars or rails of metal, or may run on two small wheels at *F* to lessen friction, and the piston-rod may rest and run on another such wheel, *o*. Evidently, by pushing or pulling the piston towards either end of the pump-case, the air between the piston and that end will be driven out there, while an equal quantity will enter at the other end. To complete the pump, therefore, it is necessary only to have the case closed at both ends by valves, so that the air shall be free to move only in the directions desired. These valves are made by placing frames, supporting wire-gauze, across the ends *A C* and *B D*, and hanging curtains of light cloth against the gauze on the side to which the air is to pass, as represented here by the oblique lines. If the upper halves of the gauze-frames have curtains opening inwards, and the lower halves have curtains opening outwards, the direction of the air-currents when the piston is moved will correspond; and if the pump be four feet high and wide, and six feet long, containing therefore nearly 100 cubic feet of air, then a movement of the piston from near one end to near the other will force about 100 cubic feet of air out at the lower curtain, while an equal quantity will enter by the upper curtain of the other side. By then reversing the motion of the piston, 100 cubic feet of air will be driven out at the bottom of the other side. Five double strokes of such a pump would give 1,000 cubic feet of air, and ten strokes might be made in a minute, giving 2,000 cubic feet, which continued would be a ventilation for five hundred persons. A large ward in a hospital might have the whole air in it changed by such a pump in a few minutes.... Air-channels connected with the valves which open inwards become exhausting or *vacuum* channels, and air-channels connected with the other valves which open outwards are forcing or *plenum* channels. The pump is, therefore, equally a forcing or an exhausting pump. It may be placed, as most convenient, within the place to be ventilated, or without. It may be fixed in its position, or may

be a moveable piece of furniture, to be used, for instance, to draw air from the top of a window opened on a ball night. . . . Of the channels to be connected with the pump, some may be of wood, some of canvass. By such a pump, therefore, air of perfect purity may be taken from any neighbouring situation, as from the top of a tower, to supply a dwelling placed where unwholesome effluvia might enter by the doors or windows."

To go back ; soon after the appearance of Dr. Hales' scheme, a new plan of ventilation was suggested by Mr. Samuel Sutton, which met with the approval of the distinguished Dr. Mead, and was submitted to the consideration of the Admiralty authorities in 1741. I notice this plan specially, because it introduces a systematic attempt to make a chimney a ventilating shaft. Mr. Sutton, in fact, made a discovery, which is here given.*

(Mr. Sutton *log.*) "I at length found that by stopping the air out of a room that had three fireplaces, and making two large fires in two of them, I could bring the air to draw down the blind chimney" (syphon ventilation on a grand scale) "with such force as to put out a candle."

Pushing his experiments still further, Mr. Sutton concluded, "that a fire being always kept on board ship, and a pipe or cavity made to the well, one end of it being heated by fire, a change of air would follow, and by this means be rendered sweet and pure and fit for respiration."

In the application of this scheme to the ventilation of ships, Mr. Sutton proposed that tubes from various parts of the ship should be made to open into, or rather beneath, the furnace of the great copper, in which the provisions of the crew were cooked ; he thus supplied the fire with air from

* Medical Works of RICHARD MEAD, M.D. London : 1762.

all parts of the ship, and kept up a constant current throughout all the compartments.

The primitive ventilation contrivance which it was Mr. Sutton's ambition to annihilate in ships, and to supersede by his own, was, nay *is*, the famous "wind-sails plan". The wind-sails are made of sailcloth, and are usually between twenty-five and thirty feet long, according to the size of the ship. They take the form of cones ending obtusely. When they are used, they are hoisted by ropes to about two-thirds or more of their height, with their bases distended circularly by hoops, and their apices hanging downwards in the hatchways of the ship. Above each of these one of the common sails is so disposed, that the greatest part of the air rushing against it is directed into the wind-sail and conveyed, as through a funnel, into the lower part of the ship. This mode of ventilation is inefficient, cumbersome, and troublesome, but Mr. Sutton did not succeed in putting it down. It flourishes still, but in some ships metal funnels ending in tubes are now used instead of the wind-sail.

Since the time of Dr. Hales and Mr. Sutton, many other ventilation schemes have been proposed. I must, however, be content to refer only to such in the sequel as are of the most modern date.

The genius of these latter days has bewildered itself and others so extensively in devices of ventilation, that the saying of a wretched punster, "the whole question of ventilation requires to be thoroughly ventilated", conveys some touch of truth. To sum up in a few words what the genius of the age has done in this respect, however, would be but to say that it has inherited all the ideas of its grandfather, which ideas it has profoundly vocabularised, and reduced in some cases to the most difficult formulæ. The primitive ideas are not

more than three in number. 1. To ventilate by heat. 2. By a pumping process. 3. By no process at all, except by the pressure and movements of the atmosphere, without let or hindrance—old nomadic system modernised. It will be well to consider these plans in order, and to refer first to Dr. Arnott's views of the uses of chimneys, and his own ventilating valve.

“What is incorrectly called the chimney-draught”, says Dr. Arnott, “is a force exactly equal to the difference of weight between the dilated air in the flue and an equal column of the external atmosphere. This explanation shows why chimney-draught is directly proportioned, first to the dilatation, and therefore to the heat of the air in the flue, and then also to the length or height of the chimney, and it accounts for many of the common cases of smoky chimneys, and suggests appropriate remedies. An influence often overlooked, but of considerable importance, because it continues in operation during the summer, is produced by wind blowing directly across the end of an open tube, such as a chimney-pot. The stream of air, splitting on the chimney-pot, causes a degree of vacuum at the mouth, towards which the air from below moves.”

“In sitting-rooms, bed-rooms, nurseries, and enclosed places generally, where people assemble, the impure air of the breath, the burned air from lights, the odour of dishes, etc., because heated and therefore specifically lighter than common air, all ascend first towards the ceiling; but, as in ordinary rooms, no opening exists there for escape (for an open window-top in a room which has an open fireplace only admits the cold air), they soon contaminate the whole air of the room down to the level of the chimney mouth, through which only can any portion ultimately pass away....

“The ventilating valve is placed in an opening made from the room into the chimney-flue, near the ceiling, by which all the noxious air above referred to is allowed at once, in obedience to the chimney draught, to pass away, but through which no air or smoke can return. The valve is a metallic flap to close the opening, balanced by a weight on an arm beyond the hinge. The weight may be screwed on its arm to such a distance from the axis, or centre of motion, that it shall exactly counterpoise the

flap; but if a little further off it will just preponderate, and keep the flap, when not acted on by entering air, very softly in the closed position. Although the valve, therefore, be heavy and durable, a breath of air suffices to remove it; which if from the room, opens it, and if from the chimney, closes it; and when no such force interferes, it shuts. The valve is so adjusted originally as to settle always in the closed position. An important part of the arrangement is the wire, which descends like a bell-wire from a valve to a screw or peg, fixed in the wall within the reach of a person's hand, by acting on which the valve may be either entirely closed, or left free to open in any desired degree. In cold weather, or with few persons in the room, the valve, when opened only a little, allows as much air to pass as is requisite. A flap of thirty-six square inches area is large enough where there is good chimney-draught for a full-sized sitting-room with company.

"It is to be observed that if the opening or throat of the chimney-flue over the fire be so wide that more air can easily enter there than can escape at the chimney-pot above, the chimney will not take air in also at the ventilating valve. It is essential, therefore, that with ordinary grates the register flap be so far closed, that when the fire is lighted, little more than the true smoke shall be allowed to enter; and not also, as is usual, much of the pure air of the room escaping with it to waste. A second great fault in common fire-places is the large space left between the fire and the chimney throat, in rising through which the true smoke contaminates much good air, which must then be allowed to pass away as smoky air."

Such is Dr. Arnott's valve; it has been extensively adopted, and when correctly fitted up, it acts well.

A second process for ventilation by means of the chimney has been patented under the title of the "Syphon Ventilator."* Essentially it consists in bringing down a tube from the upper part of a room and making it enter the chimney at the lower part, or mouth. This system has been also applied to lamp burners, a tube being carried

* For description, see JOURNAL OF PUBLIC HEALTH for June 1855.

from the burner into the chimney, so that a current of air is constantly being draughted from above the burner, through it, and so into the main shaft. Dr. Arnott hits mercilessly hard at this plan, stating that the descending tube weakens the force of the draught. There can be no doubt that the term "syphon ventilator" is unhappy and even incorrect. But for removing the air from gas burners the principle succeeds well, and a room may be temporarily ventilated pretty effectually on this plan, by simply carrying a pipe from the top of the room downwards to the chimney, and bending its lower end so as to make it turn into the chimney shaft.

In 1836, Mr. Tredgold, in his work, *On the Warming and Ventilating of Buildings*, gave an idea of a system of ventilation by means of an "inverted syphon". He gives a drawing of this instrument. By his plan, the opening at the end of the long leg of the tube communicates with the air of the room near the ceiling, and the bend of the tube is brought in contact with the side or back of the grate, so that the air in the other or shorter leg, and which runs up the chimney, may become warmer than in the leg descending from the ceiling. In this way motion will take place; for the air will ascend in the warm leg and go up the chimney, and a descending current in the cool leg will take the air from the room.

A third patented process is that of Mr. Watson of Halifax. It consists in splitting the chimney into two parts by means of a diaphragm, or central partition. Under these conditions the smoke from the fire is presumed to ascend by one of the divisions of the chimney, while a current of air descends through the other division. The same plan

has been suggested by Dr. Cowan,* the idea being taken from the statement of Commander Priest, an officer of the royal navy, who found that by straining a piece of canvass vertically across the deck of a ship at the opening to the engine room, the temperature below was rapidly lowered. Mr. Watson's plan has been adopted in the General Post Office, London, and in many public buildings; but I am not able to record positively its success.

Various attempts have been made of late to effect a perfect system of warming and ventilating at the same time. In the prison of the Mazas, in Paris, this has been attempted by M. Grouvelle. "The air supplied to the cells in this prison is heated" (I take my description from the work of Drs. T. Richardson and Ronalds†), "by contact with pipes containing hot water. Ventilation is produced by a vast chimney, about 40 square feet in section, and nearly 100 feet high, which is situated in the centre of the edifice. The whole of the air from the cells is drawn by the action of this chimney in a downward direction through a vertical pipe in each cell, which being in connexion with a night stool, serves, at the same time, for removing excrementitious matters. The pipes from the several cells terminate in an underground vault, whence the vitiated air is drawn off by the chimney draught. A balcony extends along each corridor, at the height of the first and second stories, on to which the cell doors open. Channels are carried below these balconies, in which two sets

* JOURNAL OF PUBLIC HEALTH, December 1855.

† Library of Illustrated Standard Scientific Works. Chemical Technology. Vol. i, Part i, Fuel and Its Applications. By Drs. RONALDS and T. RICHARDSON. London: Baillière. 1856.

of cast iron pipes convey currents of hot water in opposite directions. The channel is intersected by partitions, corresponding with the walls of each cell, and the air from the corridor is admitted to the spaces between these partitions by gratings, and thence, after coming into contact with a considerable surface of pipe, is admitted through several apertures to the interior of the cells." The chimney is said to be capable of drawing 1,059,300 cubic feet of air per hour, which, as there are 1,200 cells altogether, is equivalent to 882.7 cubic feet per cell per hour, or double the quantity required. By means of registers in the air vaults, the ventilation can be made uniform. The authors commend this system, call it "very admirable", and "worthy of imitation by governmental boards in this country." I congratulate these gentlemen that they speak only of this ventilation from hypothesis; for if they had tried it practically for thirty-six days, as has one who is known to me, they would possibly substitute "execrable" for "admirable", and recommend our "governmental boards", in the name of humanity, to try no such experimental tricks on British soil.

Another plan of warming and ventilating is that of M. Duvoir. This has been carried out in the Hôpital de Lariboisière, and in many other public buildings in Paris. In this plan an open reservoir for hot water is placed in a large main shaft at the top of the building. The radiation of heat from this reservoir rarifies the air in the main shaft, into which transverse shafts open, which receive a series of ventilating tubes from all the wards of the building. The ventilating tubes run up the walls of the wards, and have two openings communicating with the wards, one at their upper, the other at their lower part. By closing the upper openings the room

can be ventilated from beneath, and all impurities can thus be swept downwards; by closing the lower openings and opening the upper ones, the wards can be ventilated by a current upwards. The external air is freely let into the wards by numerous channels. Duvoir's plan is said to work well, and to be inexpensive.

The ventilation of the Newcastle Infirmary, executed by Mr. Dobson, is for many reasons the simplest and best of all the artificial systems with which the reader can be made acquainted. I must trespass again on the authors of the *Chemical Technology* for a description of this scheme.

“The wards are double. They are divided by a wall, in which are the open fireplaces and ventilators. This wall is perforated with large circular openings to allow a free communication for the air from window to window, which can be regulated according to the direction of the wind. When open, the sash of the window is at an angle of inclination, causing the cold air to enter above the heads of the patients. Cold air is also admitted at the table foot at a sufficient distance from the beds to produce no inconvenience. The outside walls are built hollow, having an air vent, three inches wide, communicating with the atmosphere by air holes at the top and bottom. A current of air is thus established, which prevents the deposition of moisture on the walls. From this vent the cold air is conveyed by an air channel along the beams which carry the floor, and is admitted at the table leg, where there is a valve which can be closed at pleasure. The contaminated air is removed from the wards by exhaustion on a simple plan. The fireplaces in the parallel wards are placed back to back, having a malleable iron air chamber between them, protected from the action of the fire by fire clay lining. It is perforated at the top and bottom to allow the atmosphere, which is supplied to it from the room below, to become heated and pass off by the ventilating flue. Thus the heat of the fire in the ward above is made to ventilate the ward below.” (p. 248.)

This plan is said to be at once simple and efficient. In the House of Commons, a plan of Dr. Reid's is adopted.

“The air is supplied from Old Palace-yard to the basement of the building; passing first through a filter, 42 feet long by 18 feet 6 inches deep, for the exclusion of visible soot, it arrives at the heating apparatus, consisting of large chambers intersected by steam pipes, and proceeds from thence to other chambers, where it can be mixed with cold air and brought to any required temperature. The floor of the house is double, and the space below the floor can be connected by means of valves with the hot air chamber. The floor is perforated by a great number of apertures, and these are covered with air cloth to diffuse the current. The air having performed its functions ascends to the ceiling, which is also double and perforated, whence it is carried off by the draught created by a powerful fire up a chimney shaft erected in another part of the building.” (*Chemical Technology*, p. 251.)

The House of Lords is ventilated on a simpler plan; which is the less remarkable, because one more complicated than the above could not easily have been conceived.

“The floors of the rooms are simply heated by the passage of hot air beneath them. The hot air then escapes by passages along the external sides of the rooms to the ceiling, which is divided into two compartments, the one for the admission of the warm air entering at the sides, and the other for the exit of the vitiated air. The warm air, after passing below the floor to the roof, becomes somewhat cooled, so that its temperature on entering the ceiling is a few degrees lower than that actually present in the room; it consequently descends to the level, at which it is at once heated again, and deteriorated by respiration, it rises through the centre of the room through the ceiling to a foul air chamber above, whence it is conducted to a chimney. In the chimney it is carried off by a motive power first suggested by Dr. T. Richardson. This power consists of a jet of steam, which when produced under pressure of 32 lbs. to the square inch, is capable of setting 217 times its bulk of air in motion: 10,000 cubic feet of air are thus gradually diffused per minute, no draught is perceptible, and no inconvenience from dust.” (*Chem. Tech.*, p. 251.)

The exhaustion process through a shaft, by means of heat, has been applied in various other ways. In mines, a fire in

the ventilating shaft acts exceedingly well. The upper manufactory rooms of Mr. Goode, of Birmingham, are ventilated by the simple plan of placing a refrigerator gas burner within a cone from a shaft ascending through the roof of the building. The air is admitted freely from without by the doors and other openings in the walls, and the draught through the shaft is most effective. This arrangement, adapted to use by Mr. Goode, junior, answers better than any previous one which has there been tried.

The ventilation of gas burners is a subject that has received great attention. I have already said that the principle of the so-called "syphon ventilator" is good for this purpose, for I have seen it applied in this manner, and I find that it causes a brisk current of air to pass downwards through the burner into the chimney, and not only removes the products due to the combustion of the gas, but assists also to some extent in ventilating the room in which the burner is fixed.

A few years since, Mr. Faraday invented a ventilating gas burner.* This consists of an Argand burner with a glass chimney, both of which are enclosed in an outer and larger glass cylinder, which is closed at the top by a plate of mica. The plate at bottom on which this outer cylinder and the lamp chimney rest, has an opening between the outer and inner glass cylinders, from which runs a pipe ending in a ventilating flue. The air to supply the flame is supplied by a separate pipe. When the lamp is in action, the air passing up the chimney lamp cannot escape at the top into the room, being prevented by the mica plate; it descends in

* On the Ventilation of Lighting Lamps. By Professor FARADAY. Paper read before the Institute of Civil Engineers, June 27th, 1843.

the space between the two glass cylinders, and escapes by the ventilating flue. The great disadvantage of this plan is that the current of hot air passing between the two glass cylinders renders the glass opaque. Mr. Rutter has invented a mode of meeting this objection ; but as a tube from the gas burner into a chimney, on Dr. Chowne's suggestion, called the "syphon ventilator", is without any other addition sufficient for the end desired, it is not necessary to enter into further descriptions. In a room furnished with a well acting Arnott valve, the evils of the gas burner are also mainly removed.

The second method of ventilation is by a pumping or other mechanical exhausting process. I have referred to plans of this kind in speaking of Dr. Hales' invention. For modern improvements in this direction, the public are much indebted to Dr. Arnott, whose single ventilating pump admits of wide application. His gasometer ventilating process is also exceedingly ingenious, and is used in the York Hospital. It is, in a sentence, an air-pump. An air cylinder or gasometer moves up and down in a case more than twice as deep as itself, within which in its middle part is formed as a lining to it a thin circular trough of water, into which the open mouth of the cylinder plunges as it works. The case has at top and bottom certain valves on each side opening in opposite ways, and as the cylinder plays up and down in the case, pure air is alternately received into and driven out of the spaces below and above the cylinder, so that whether the cylinder be rising or falling, air is being pumped onwards into the ventilating channels of the house. In the York Hospital, the machine is worked by a small water engine ; eight complete strokes of the pump are made per minute, giving a ventilation of 2,000 cubic feet in the same time.

A further plan of warming and ventilating at the same time is also the invention of Dr. Arnott, under the title of the "double current warming ventilation". In this process, by means of the ventilating pump, the heated impure air which accumulates at the top of a crowded room, is made in passing through tubes to transfer its heat to pure air passing through other tubes from another pump to feed the room.

Other schemes of ventilation by fans, ventilating pumps, steam jets, and the like, have, at various times, been employed. The principle is the same in all; Hales' bellows improved upon or modified, and his Highness the Prince, to whom the reader has already been introduced, disgusted as usual, and in most cases obstinate. When Dr. McWilliam went on the Niger expedition, the steamers engaged in the expedition were ventilated by Dr. Reid on the "plenum and vacuum principles."* A fanner, or ventilating machine, was put in motion either by the machinery of the steam engine, or by the "krooman"; or, when in the river, the paddles being disconnected from the engine, by the paddles themselves, which acted as water wheels. From the ventilator a series of tubes proceeded to all the compartments of the vessel. When the fanner worked on the "*vacuum principle*", the vitiated air was drawn by it from the various compartments, and was discharged at an opening in the circumference of the fan box. When the "*plenum principle*" was resorted to, the fresh external air was connected with the centre, and blown into the distribution tubes to the several compartments. By this means it was hoped that, under any

* Medical History of the Niger Expedition. By J. O. McWILLIAM, M.D., Senior Medical Officer of the Expedition. London: Churchill. 1853.

circumstances, fresh air might be infused into, or vitiated air extracted from, the hold, or any part of the vessel. At some periods in this voyage the air was driven through a medicator, with the intention of removing carbonic acid, and evolving chlorine. How far this medication was useful, Dr. McWilliam does not "pretend to determine". The ventilation simply seems to have been tolerably successful.

I turn now to the third mode of ventilating, the true natural system, that, namely, of letting the atmosphere take its own course, giving it entrance everywhere, and escape everywhere. It may be that, under some circumstances, this system cannot be fully carried out, as in the well of a ship, and in underground rooms. In such cases the simplest of the artificial plans of ventilation may be useful; and Arnott's valve is generally advantageous in any room where there is a chimney, except in cases where a large ventilating shaft, distinct from the chimney, is also in action, when the play of the valve is nullified.

But whenever it is possible to give the atmosphere free and natural vent, the best ventilation is at once procured, while the secret of the avoidance of draughts lies not in shutting out the atmosphere, but in letting it in freely. Men do not take colds when bathed in the atmosphere out of doors; nor would they in their houses if the atmospheric influence were as general within doors as it is without. But when one part of the body is exposed to a warm atmosphere, and another to a cooling draught from some chink of a window, the circulation through the skin is of necessity rendered unequal, and a cold is the result. The absolute rule of ventilation ought to be, *to admit air into dwellings as freely as*

light; a difficult thing to do, it is granted, but the end, after all, to be had in view. On this point Dr. Steele says: * “Ventilation may be subdivided into two branches; the theoretical and the practical. It is useless to deny that the majority of these attempts”, the artificial or theoretical, “have signally failed”, and he then quotes the words of the Newcastle Committee of Inquiry on Ventilation, which run thus: “With regard to ventilation, we have seen a great diversity of systems, and observed that the most complicated and expensive is that which has generally been found to be the least effective. In some we found furnaces and towers, built specially for this purpose, but now entirely thrown aside. In those whose ventilation was most perfect, we found the system most simple and natural.”

Ventilation, whether in the wards of hospitals or in the rooms of private houses, should be effected by free openings for both the entrance and the egress of the atmosphere. The doors and windows admit, when properly arranged, for the entrance,—the chimney, when properly arranged, for the exit. The windows should extend from the floor to the ceiling of every room, they should open freely, and the plan of introducing some perforated glass panes, as proposed by Dr. Steele, should be universally adopted. Rooms also, whether wards or private rooms, should properly communicate by at least two of their sides with the air, and in isolated houses by all sides, so that a free air current may pass through, and the force of the wind be brought into play, from whatever quarter it may blow.

As regards the chimney of a room, I believe that the

* Observations on the Construction and Ventilation of Hospitals for the Sick. By JOHN C. STEELE, M.D., Superintendent of Guy's Hospital. Glasgow: 1856.

old fashioned open chimney is the best for ventilation, and the open fireplace by far the healthiest for warming. This opinion about open chimneys was held by Dr. Hales, and the reader is requested not to run away with any idea of discomfort in thinking of a revival of this old practice. Living once for some weeks in a room with a chimney open to the ceiling, I experienced no inconvenience whatever, but, on the contrary, found all the pleasure arising from the inhalation of an atmosphere constantly removed from within, and renewed from without. Downward draughts and damps of smoke were unknown, and might be prevented in all cases by care in construction. Certainly the open chimney removes the possibility of the richly laden mantelpiece and the magnificent mirror. But what of that? who wants to admire his own shadow at the expense of breathing his own poison?

The hospital at Bordeaux, described by Mr. Robertson,* is ventilated in the simplest way; viz., by having isolated wards, and these open to the air, from side to side and from end to end, by means of long windows, so that a current is always passing through, "in correspondence with the natural laws of the atmosphere".

In carrying out this, the only natural plan of ventilation, the perforated zinc or glass plates are most useful. Through them the air passes finely distributed, to use a common term, and the danger of the "draught" is removed.

A few words yet have to be said regarding the amount of air that each individual requires. A very difficult question

* On the Defective Ventilation of Hospitals. By JOHN ROBERTON, Surgeon. Manchester: 1856.

is here involved, since we do not always take in the same amount of air, nor always give up the same amount of carbonic acid. Some persons, it is true, have fixed upon arbitrary rules. It has been said that two hundred and twelve cubic feet of air per hour are required to remove all the exhalations of the body, and that a certain number of cubic feet in space are required to secure good health. But practical facts set the calculators' arguments aside, and show that everything depends on the mode of ventilation. Place a man in a coffin with plenty of holes in it, so that his Highness the Prince aforesaid can stroll through it at pleasure, and the man certainly will not die from want of air. Place the man in St. Paul's; seal him up there for good, so that his Highness the Prince can in no way and nowhere wedge himself in, and the man will die in time from actual want of air. A slave, in a slave-ship, has been made to exist in a space of fourteen cubic feet; in the London Hospital, some of the patients are allowed to luxuriate in a space of one thousand seven hundred cubic feet.

There is, in fact, no strict rule in reference to cubic space: the safest approximation to a rule is this; to give to each person as much space as possible, and to ventilate that space as freely as possible. In hospital wards, under any system of ventilation, one thousand cubic feet should possibly be the minimum allowance. In private houses, especially in the sleeping-rooms, not less than five hundred cubic feet should be secured.

It is not my intention here to dwell on the subject of the effects of impure air on health. The emanations from the bodies of men and animals are chiefly carbonic acid, ammonia, and water. The poisonous character of the first of

these when inhaled is well known. Dr. Bence Jones assumes, from the experiments of Le Blanc, that air containing one per cent. of carbonic acid indicates so impure a state of the atmosphere, that if breathed for twelve hours it would prove injurious, and adds many most valuable and trustworthy facts on this complicated subject, to which I would direct special attention.* In large doses, the acid kills at once, by arresting the respiration and the oxidation process. What the mischiefs are which arise from the inhalation of small quantities of ammonia the physiologist has yet to learn.

* On Ventilation, and the Means of Determining its Amount. Lecture delivered before the Royal Institution. By H. BENCE JONES, M.D., F.R.S. Reported in the *Chemist* for June, 1856.

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